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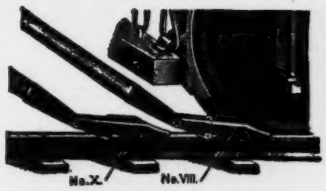

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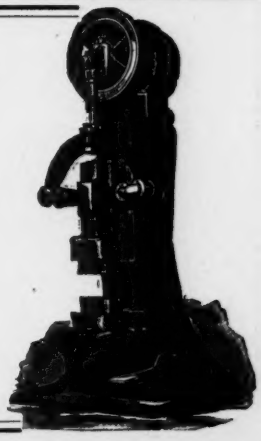

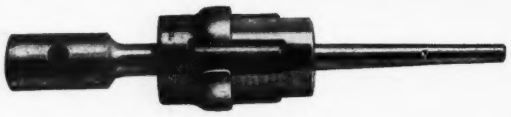

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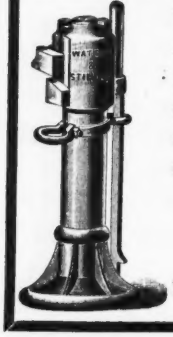

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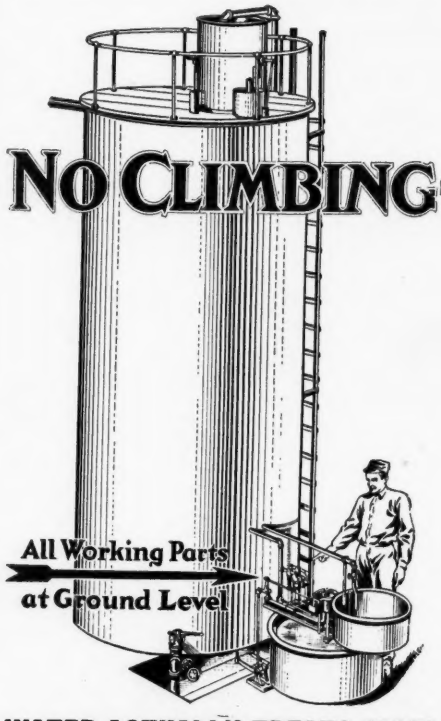

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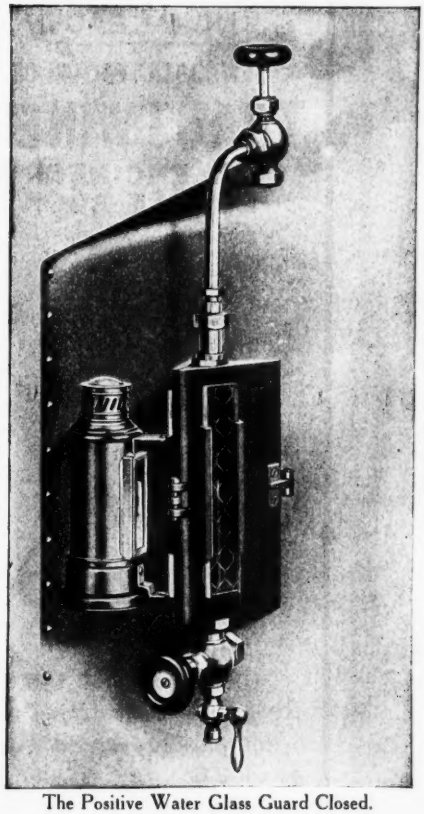

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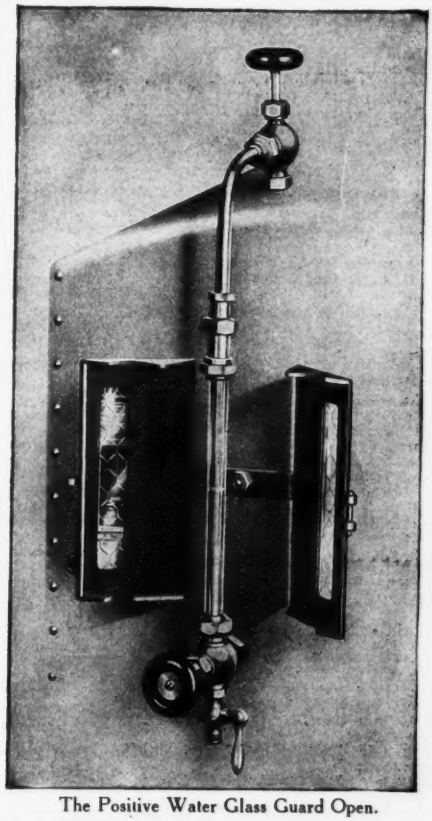

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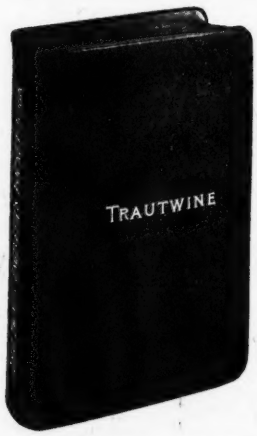

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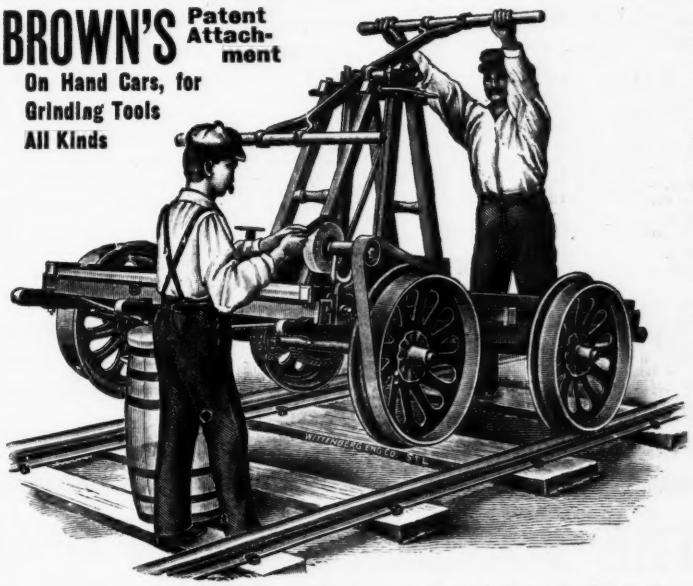

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Buda Foundry & Mfg. Co., Chicago.

Turnbuckles.
Cleveland City Forge & Iron Co., Cleveland, O.

Varnishes.
Devoe, F. W., & Co., New York.

Velocipedes, Railway.
Railway Supply Co., St. Louis.

Water Columns.
American Valve & Meter Co., Cincinnati.

Water Proofing.
Standard Asphalt & Rubber Co., Chicago.

Water Softening Apparatus.
Kennicott Water Softener Co., Chicago.

Water Tanks.
Adreon & Co., St. Louis
Railway Supply Co., St. Louis.

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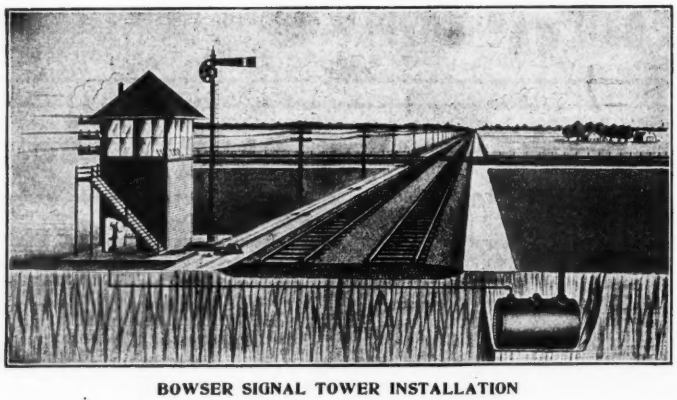
Railway Supply Co., St. Louis.

Wrecking Cars.
Buda Foundry & Mfg. Co., Chicago.

Wrecking Frogs.
Railway Supply Co., St. Louis.

THE BOWSER SYSTEM OF OIL STORAGE



BOWSER SIGNAL TOWER INSTALLATION

Because of its clean, economical and convenient features, the Bowser System has been adopted by over twenty railroad systems. For that reason it is recognized as

THE STANDARD RAILWAY OIL STORAGE SYSTEM

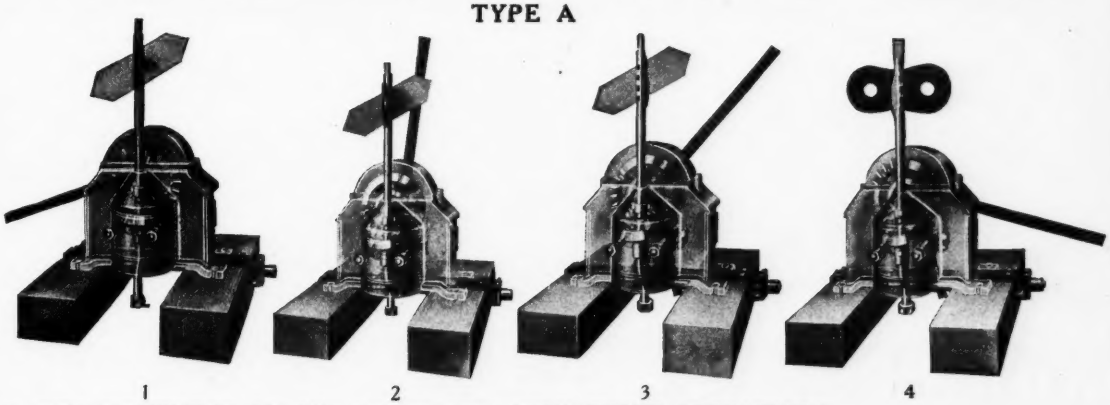
Bowser equipments have been installed and are in successful operation in oil houses, store-houses, machine shops, coach yards and signal towers.

Everywhere oil is handled, the Bowser system can and should be used. Send for Bulletin VII.

S. F. BOWSER & CO., Inc.
FORT WAYNE, INDIANA

FOSTER
INTERLOCKING SWITCH STAND

TYPE A



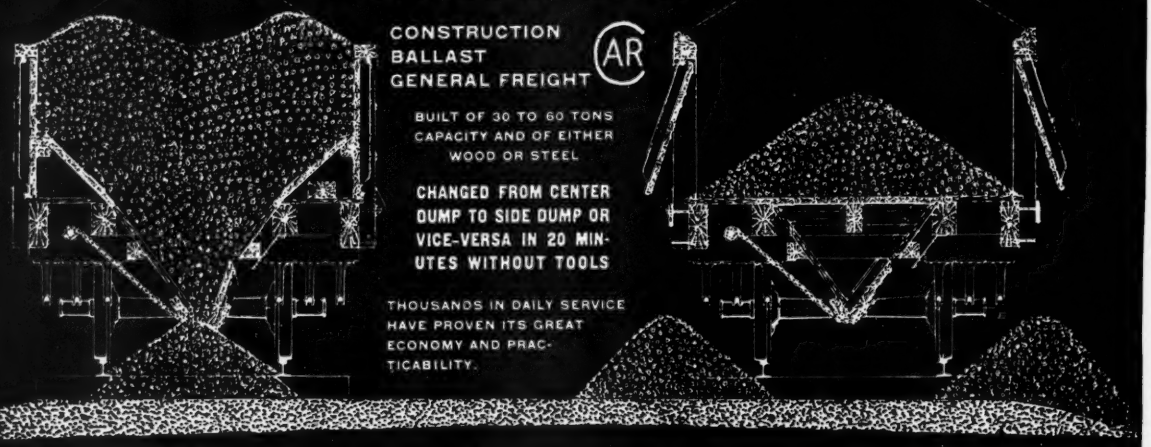
1 2 3 4

1. **ONE MOVEMENT OF ONE LEVER PERFORMS THREE OPERATIONS.**
2. Moving the lever from 1 to 2 closes the switch; from 2 to 3 interlocks points; from 3 to 4 clears home and distant signals.
3. Moving lever from 4 to 3 sets home and distant signals to danger; from 3 to 2 withdraws interlock; from 2 to 1 opens switch.
4. **EASY AND SIMPLE TO OPERATE.**
5. While all operations are accomplished with one lever it only requires power enough for one operation at a time.
6. Each gear remains locked except when performing its function, and each operation must be completed before the next is possible.
7. **SIGNALS CANNOT BE CLEARED UNLESS POINTS ARE INTERLOCKED FOR MAIN LINE.**
8. If point does not come up to stock rail, plunger will not enter lock bar and lever will stop between 2 and 3.
9. All stands are provided with chain sheave to connect with distant signal.
10. Switch crank throws 180 degrees and locks on dead center. Pressure on the points will not throw the lever over.
11. When the lever is down on either side all gears are out of mesh and locked on driving gear.
12. The strain on wires from distant signal will not turn the lever as teeth do not engage till lever is raised above latch.
13. **DOUBLE PROTECTION FOR SWITCH POINTS. TWO INDEPENDENT CONNECTIONS FROM POINTS TO TIES.**
14. Connecting rod and lock bar connect with points independently providing against defective switch connections.
15. The interlock is spiked to ties before stand is set and the stand will lift off without disturbing the interlock.
16. If interlock connection is made below top of ties it holds point safe if switch connection is defective or destroyed.
17. **EASY AND SIMPLE TO INSTALL.**
18. Notch ties and spike interlock in position located according to length of connecting rod.
19. Set stand with feet against steel plate and spike down. Latches are on the housing and need not be spiked separately.
20. **PROTECTION OF DISTANT SIGNAL PROVIDED WITHOUT EXTRA LEVERS TO OPERATE.**
21. To switch cars on main line and keep signals set at danger move the lever between positions 1 and 2.
22. In opening the switch the first movement of the lever sets the signals to danger before the switch is unlocked.
23. If the switch is left open the distant signal is held at danger and protects approaching trains.
24. **A COMPLETE INTERLOCKING UNIT FOR SINGLE FACING POINT SWITCHES.**
25. This stand is especially adapted to outlying facing point switches.
26. It provides interlock and distant signal protection for facing point switches.
27. All operations being under control of one lever it does not require experienced men to operate it.
28. When the lever is moved from one side to the other each operation is completed in its proper order.
29. Each operation has to be properly executed and completed before the next one is possible.
30. Connection from the chain sheave can be made by wire to distant signal, or to pole changer for power signals.
31. Foster interlocking switch stand.
32. Only one lever for all operations.
33. Sent on approval.
34. Tested by a year's service.
35. Easy to install and easy to operate.
36. Reliable and positive mechanism.

FRANK M. FOSTER 515 W. FIRST AVENUE **Columbus, Ohio**

RODGER BALLAST HART CONVERTIBLE CAR

THREE CARS IN ONE


CONSTRUCTION
BALLAST
GENERAL FREIGHT
CAR
BUILT OF 30 TO 60 TONS CAPACITY AND OF EITHER WOOD OR STEEL
CHANGED FROM CENTER DUMP TO SIDE DUMP OR VICE-VERSA IN 20 MINUTES WITHOUT TOOLS
THOUSANDS IN DAILY SERVICE HAVE PROVEN ITS GREAT ECONOMY AND PRACTICABILITY.

RODGER BALLAST CAR CO. RAILWAY EXCHANGE CHICAGO, ILL.

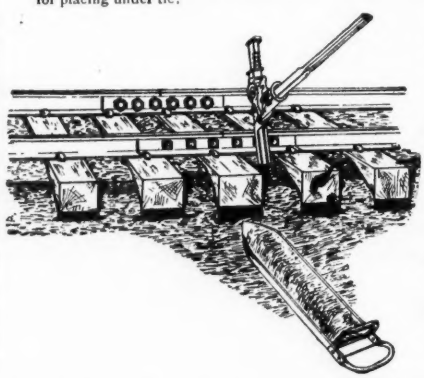
WALTERS'

BALLAST PLACING DEVICE

Patented March 21, 1905

Has been placed in service on eleven trunk lines and eight smaller railroads since April 1st.

FIG. 1—Showing ballast removed from end of ties to be raised, track jacked up and device in position to receive ballast for placing under tie.



We will guarantee that every particle of ballast will remain under tie and that machine will work in any kind of ballast.

Order Samples

Satisfaction guaranteed or money refunded.

References: Any Bank in the City.

FIG. 2—Showing pan removed, ballast under tie, and cleaner ready to be withdrawn.

WALTERS & OKELL

Ft. Madison, Iowa

We Sell

Good

Bridge

Paint

Send for an attractive collection of half tone engravings showing prominent bridges painted with

Superior Graphite Paint

—

Detroit Graphite Co.,

DETROIT, MICH.

Track Laying by Machinery

Simple—Rapid—Economical

D. F. HOLMAN RAILWAY TRACK LAYER CO.

1105 Ellsworth Bldg, Chicago

Railway Engineering

and Maintenance of Way

Mr. W. R. Hollick has been appointed a roadmaster of the Atchison, Topeka & Santa Fe, with office at Canadian, Tex.

Mr. John A. Knox has been appointed engineer of the Louisiana & North-West, with office at Homer, La., succeeding Mr. W. A. Hunicke.

Mr. E. F. Holland has been appointed a roadmaster of the Marshall & East Texas, with office at Marshall, Tex., succeeding Mr. S. R. Stewart.

Mr. C. C. Berkeley, division engineer of the Oregon Railroad & Navigation Company at Portland, Ore., has been appointed assistant engineer of the Oregon & Washington, with office at Seattle, Wash.

Mr. W. L. Allison, mechanical engineer of the Atchison, Topeka & Santa Fe at Chicago, has resigned to become mechanical manager of the Franklin Railway Supply Co., New York, with office at New York.

Mr. F. E. Patton has been appointed a road foreman of engines of the Mobile & Ohio, with office at Mobile, Ala.

Mr. James C. Fritts, foreman at the Hoboken, N. J., shops of the Delaware, Lackawanna & Western, has been appointed master car builder, with office at Scranton, Pa., succeeding Mr. Robert F. McKenna, resigned.

Mr. A. F. Stotler has been appointed a division engineer of the Oregon Railroad & Navigation Company, with office at Portland, Ore., succeeding Mr. C. C. Berkeley, resigned. Mr. C. C. Blood has been appointed a division engineer of the Southern Pacific Lines in Oregon, succeeding Mr. W. Bollons, assigned to other duties.

Mr. A. C. Olney has been appointed chief engineer of the Tampa Northern, with office at Tampa, Fla., succeeding Mr. John Pasco.

Mr. J. J. Harrison has been appointed chief engineer of the Missouri, Oklahoma & Gulf, with office at Calvin, Okla., succeeding Mr. E. J. Noonan, resigned.

Mr. John A. Lee, shop and engine-house foreman of the Western Allegheny at Kaylor, Pa., has been appointed master mechanic, with office at Kaylor, succeeding Mr. J. H. Marks.

Mr. C. W. Lee has been appointed master mechanic of the Raleigh & Southport, with office at Raleigh, N. C., succeeding Mr. George L. Womble. The title of Mr. A. E. Guess has been changed from supervisor to roadmaster.

Mr. B. H. Bryant has been appointed chief engineer of the Mexico North-Western, with office at Chihuahua, Mex. This company has taken over the Chihuahua & Pacific, the Sierra Madre & Pacific and the Rio Grande, Sierra Madre & Pacific.

Mr. W. L. Kellogg, superintendent of motive power and car department of the Pere Marquette at Detroit, Mich., has been appointed superintendent of motive power of the Cincinnati, Hamilton & Dayton, with office at Lima, Ohio, and will have charge of the locomotive and care department.

Mr. William Boughton, master mechanic of the Pere Marquette at Saginaw, Mich., has been appointed general master mechanic in charge of locomotive and car departments, with office at Detroit, Mich., Mr. W. L. Kellogg, superintendent of motive power and car department, having resigned to accept service with another company.

Mr. J. H. Phillips, assistant engineer at Hoboken, N. J., in charge of the Susquehanna grade crossing elimination work of the Delaware, Lackawanna & Western, has resigned to go into other business. Mr. Phillips had charge, under the supervision of Mr. E. I. Contine, division engineer, of boring the second Bergen Hill, N. J., tunnel.

Mr. Schuyler Hazard, resident engineer of the New York Contracting Co., in charge of work on the Pennsylvania terminal station, New York City, has resigned to become general manager and chief engineer of the Orleans County Quarry Co., Albion, N. Y. Mr. Hazard is a member of the American Society of Civil Engineers and was formerly a division engineer on the New York Central & Hudson River and later roadway engineer on the Southern Railway.

The Buffalo, Rochester & Pittsburg has announced that it has abolished the office of general storekeeper and has ordered that the employes heretofore reporting to general storekeeper shall report to the superintendent motive power hereafter.

Mr. Walter Hill has been appointed roundhouse foreman of the Delaware, Lackawanna & Western at Buffalo, N. Y., to succeed Mr. Thomas Horton.

Mr. J. M. Plummer, division roadmaster on the New Orleans & Northwestern, between Bastrop and Vidalia, La., has resigned, effective September 15.

Mr. F. E. Hutchinson has been appointed chief electrician of the Chicago, Rock Island & Pacific at Chicago, Ill., succeeding Mr. W. E. Ballantine, who has resigned to accept service with another company.

Mr. J. F. Murphy, master mechanic of the Houston & Texas Central shops at Ennis, Texas, died on September 9.

Mr. J. E. Weatherford, foreman of the car department of the Houston & Texas Central at Ennis, Tex., has been promoted to general foreman of the same department at Houston, Tex., and is succeeded by Mr. James George, who advances from passenger car inspector, to which position Mr. W. R. Hall has been appointed.

Mr. George A. Kyle, former division engineer for the Chicago, Milwaukee & Puget Sound, has resigned to take charge of the surveying and engineering work of the Oregon Trunk Line down the Deschutes Valley.

Mr. J. R. Lockwood has been promoted from resident

engineer of the Marshall & East Texas to chief engineer of the same line and also of the New Iberia & Northern, both of these lines being controlled by Albert T. Perkins of St. Louis and associates.

Mr. Jesse R. Garrabrandt, formerly signal maintainer of the Erie Railroad at Jersey City, has been appointed assistant supervisor of signals on the New York division and at the terminals in New York City.

Mr. J. M. Barrowdale has been appointed assistant superintendent of the car department of the Illinois Central, with office at Chicago. Mr. A. J. McKillop has been appointed assistant superintendent of machinery of the same road. He will have his headquarters at Chicago and will be in charge of locomotives.

With the retirement of Mr. C. A. Wilson from the position of chief engineer of the Cincinnati, Hamilton & Dayton, Mr. F. H. Alfred, who, on Aug. 21 was appointed assistant to the president, has taken charge of the engineering department. He is one of the leading construction experts of the country and all improvement work will be done under his direction. It is understood that Mr. Wilson still is connected with the company and probably will be for some time in an advisory capacity. The title and duties of general purchasing agent and storekeeper have been transferred from Mr. A. L. Sanger to Mr. W. C. Atherton, who holds the same position on the Pere Marquette. He will have offices in both Detroit and Cincinnati in his dual relation to these roads. Mr. W. L. Kellogg, who has been placed in charge of motive power equipment and rolling stock, also is superintendent of motive power on the Pere Marquette. His predecessor on the Cincinnati, Hamilton & Dayton, Mr. A. C. Hickley, remains in the service, it is stated, as master mechanic at Lima.

Owing to the extensive installation of block signals on the Baltimore & Ohio Railroad during the last year it has been found necessary to reorganize the signal maintenance forces on various divisions of the road by shortening the districts and the employment of additional men. Heretofore the men in charge of the signal maintenance on the Pittsburg, Cumberland, Connellsville, New Castle, Chicago and Wheeling divisions of the Baltimore & Ohio have reported to the master carpenter. This practice will be discontinued and signal supervisors appointed, who will report to and receive instructions from the division engineers. Those engaged in the maintenance of signal appliances, including lampmen, etc., will report to the signal supervisors in the future, instead of to the master carpenters, as under the old agreement. In addition to these changes Mr. F. P. Patenall, the signal engineer, will have monthly meetings of his staff at headquarters in Baltimore. These meetings will be attended by signal supervisors and inspectors and all questions concerning signal standards, methods of construction and maintenance will be fully discussed in order to obtain the greatest practical benefit through the interchange of opinions. It is believed that these monthly meetings will result in more economical and higher class maintenance as well as increased efficiency in the performance of the signal appliances.

The Maintenance of Way Department

Tie Plates

Editor Railway Engineering:

To be candid; I have not taken as much interest in the Maintenance of Way Department, as published in your valuable paper, as I would like to on account of the lack of time, this being our busy season in this part of the country, as we only have a very short space of time to do quite a large amount of work between the times of frost going out and in. A great deal of my time is taken up on the line so that while our discussions might seem to be too brief at the present time, will be glad to dwell upon them longer a little later on when our work lets up.

As to the best type of tie plates for our road, taking into consideration the kind of wood tie that is in use, we use soft wood timber altogether and have tried several different types of tie plates. All connected with the Maintenance of Way Department on this line have come to the conclusion that the Goldie tie plate is the best that has been used thus far, with shoulder, both for curves and tangents, as it has been found that plates without the shoulder do not give the results desired, more especially during the winter months when the surface of the track becomes disturbed to a very large extent and the strain, as a consequence being upon the spike heads. Where no shoulder exists, it has been found that it only requires a short time to cut the heads of the spikes off, resulting in accidents. This applies to tangents as well as to curves as you, of course, are aware that while it might sound strange to a person, from a theoretical standpoint, it has, however, been found in practice and from my personal experience and observation, that there is more liability of spreading rails on tangents than on curves where track is out of surface a sufficient amount to cause side thrusts, as when wheels line up against the outer rail of curves they remain in the same position against the outer rail until they pass around the curve.

Our tie plates are about 7/16 ins. in thickness and taper slightly from the outer edge of the plate to the inner one; this in order to prevent the rail from canting outward, which, as everyone knows, they are inclined to do. We tried the same thickness of tie plate, above described, without any calks projecting from underneath into the ties, or in other words, a flat bottom plate; but found that while they answered the purpose of preserving the tie and gauge of track, yet it is difficult and in fact impossible to prevent them from coming loose and rattling, which is not a good advertisement. I am not quite sure whether our tie plate, above described, with the calks

projecting, the same as the Goldie, are really the Goldie make or not, but they are patterned after them.

We have a very heavy traffic here during the summer season in ore trade, averaging not less than one train per hour of ore, consisting of seventy cars of fifty tons capacity, so that you can draw your own conclusions as to what our traffic is, besides a large number of regular scheduled trains, which affords us a pretty good opportunity of determining the best kind of plates in use, although I do not wish it to be understood that we have tried all the various patterns.

Yours truly,

Wisconsin. ROADMASTER.

Tie Plates

EDITOR, RAILWAY ENGINEERING:

We use oak ties exclusively on this division, and I think that with such ties, the Goldie claw tie plate, or a tie plate of that type is best suited; we use tie plates only on our sharper curves, as there does not seem to be any economy in using them on the lighter curves and tangents, where hard wood ties are used.

Yours truly,

Kentucky. ROADMASTER.

Preservation of Ties

The following data on wood preservation formed a report by several assistant engineers in 1901. It is published because we believe it contains matter of interest, not in print heretofore.

1. NATURE AND PROCESS OF DECAY.

The decay of timber is due primarily to the actions of certain lower animals and plants, bacteria and fungi, largely the latter which induce changes in the composition of the wood, destroying its original and natural texture, when producing the various forms of decay with which we are more or less familiar. The appearance of pieces of fungus on old logs and stumps and not infrequently on railroad ties is familiar to most of us. These parasitic growths have obtained their nourishment from the sap or wood tissues. Each separate plant, thousands of which make up a piece of fungus may live wholly within the texture of the wood whether it be living or dead, desolving out and using as food certain ingredients in the sap or wood tissues resulting in the breaking down of the wood fibres and the ultimate decay of the piece of timber. The common belief that wood decays because it is disposed alternately to air and water or to one or the other of these elements alone, is true only as far as one or the other of these conditions is conductive to the growth of these bacteria and fungi. No growth can take place without water, thus absolutely dry wood is proof against decay; but as wood absorbs water very readily this condition is rarely found. Free exposure to air tends, however, to keep wood dry and so prevent decay. This fact is borne out in many instances by the sound appearance of the top surface of the tie while the bottom and middle portions, far less freely exposed to the air, are completely gone. Neither can decay take place without the presence of air, as is shown by timber which remains sound for years when sugmerged in water. Further, the weight of evidence to-day points to the fact that there is no decay without fermentation and no fermentation without germs. Hence we may safely conclude that for the process of decay to go on the presence of air, water and living organisms is necessary. Any one of these being absent decay will not take place. Considering these primary conditions in relation to railroad ties, the air of course must be present at all times. The continued presence of water we obviate as far as possible by well drained road-bad; but it is always present in some degree. Hence, to prevent decay, there remains for us to so treat the presence of germs within the structure of the wood, as well as the possibility of their future entrance therein shall be prevented: Thus the different processes for the prevention of decay aim at these two results; first, that all form of bacteria and fungi existing within the cells of the wood shall be killed, and at the same time the wood texture shall be so affected that the growth of these animal and vegetable parasites will be prevented or at least be very slow. Second, that the surface of the wood shall be made impervious to these germs.

2. PROCESS OF PRESERVATION.

The various processes for the preservation of timber, which have been advanced during the last forty or fifty years, in the order of their importance to-day for tie preservation are as follows:

1. Bethel Process; Creosoting—treating with creosote oil.
2. Burnettizing—treating with Zinc Chloride.
3. Kyanzing.
4. Vulcanizing.
5. Various sulphate processes.
6. Minor miscellaneous processes.

1. BETÄEL OR CREOSOTING PROCESS.

This process as generally carried on to-day consists in placing the ties in a large iron cylinder which is hermetically sealed at each end. Live steam is then admitted under a slight pressure, and by the aid of super-heated steam the temperature is raised to such a degree, about 215, that the walls of the wood cells are softened and sap and moisture dried off. The heat is then increased to kill all living germs that are then in the timber. The sterilizing temperature of 212 is sufficient to accomplish this result, but in order to insure this temperature throughout the cross section of the tie requires a long exposure to a temperature of 212, to 215. As a temperature of 260 or 270 will not injure the fibres of the wood, this upper limit is usually adopted as a maxium, and to prevent the rapid evaporation of the pitch and volatile oils in the wood (in the treatment of yellow

pine tree), which would follow were this temperature applied at the atmospheric pressure, pressure is applied gradually with the increasing temperature until 70 or 80 lbs. is reached. This pressure and temperature is maintained for an hour when the tie throughout is supposed to have reached a temperature of at least 212, and the wood is thus thoroughly sterilized. The heat and pressure are then gradually reduced until the pressure has been entirely blown off. The tie is now in healthy condition, that is, it has no living germs of disease within, and even at this stage of the process its life had been very materially increased. The next step is to extract as far as possible the remaining juices from the wood so that the wood may be porous and readily absorb the creosote oil. To bring about this result vacuum is applied until about 26 inches is reached, when the creosote oil is introduced at a temperature of about 180 and under a hydraulic pressure of some 200 lbs. to the square inch. At this temperature the oil more easily penetrates into cells of the wood. The ties are kept in oil under the above pressure until a sufficient amount, usually 12 to 15 pounds to the cubic foot, depending on the kind of wood, (oak and woods of similar texture taking up the oil less readily than the softer and more porous varieties), and on the specifications which govern the treatment of ties. The pressure is then reduced to nothing and the liquid withdrawn from the cylinder when the ties are removed, dried, and are then ready for use. Here the process usually ends. There are however some plants where the ties are further subjected in the second cylinder to a treatment of milk of lime under a pressure of about 200 lbs. to a square inch. This further treatment it is said hardens the creosote oil in the outer fibres of the wood, and without making it at all brittle renders the wood still more impervious to the water. This practice, however, is not general.

There are many variations in the amount of pressure, degree of heat, and time allowed in the various operations of the process, as carried on in different plants, but the principal is the same throughout. The vital point which is often overlooked is the importance of thoroughly sterilizing the timber before subjecting it to the treatment of preservative solution.

The average time consumed for the entire process is from 12 to 15 hours.

The creosote oil is obtained from the distillation of coal tar, or by the destructive distilation of pine or other resinous timber. Dead oil of coal tar with Napthalene as the chief preservative is used mainly throughout the United States. The following analysis of Dead Oil of Coal Tar, furnished by the "Eppinger & Russell Company," is the actual analysis of creosote oil used at their works at Long Island City, N. Y. for the treatment of ties in 1900.

Analysis of Dead (Creosote) Oil.

Dark Brown Material—	
Specific Gravity	102 at 80 F
Water Hydrocarbons, Phenols, etc.	3%
Phenols and Creosols	5%
Naththalene	50%
Anthracene Oil	22%
Anthracene	4%
Soft Pitch	16%
Total	100%

Above 316.

The main point of difference between American and foreign practices in regard to the creosoting process as applied to tie preservation is in the amount of oil which is absorbed by the tie. American specifications seldom require an absorption of more than 15 lbs. of oil per cubic foot of timber; while the best German specifications for example often require as high as 25 lbs. to the cubic foot. This is due in a measure no doubt to the high cost of ties and the cheapness of creosote oil as compared to the conditions in the United States, demanding a consequent increase to the increased life of the tie in order to make the treatment economical.

The increased life of the tie after treatment may be said to vary directly with the amount of oil absorbed. In the United States yellow pine ties treated by the creosoting process will last under ordinary conditions from 14 to 16 years. Experience on German railroads, however, shows results where treated ties have lasted 28 to 30 years which might be expected from the large amount of oil absorbed.

The cost of treating ties according to American practices, that is, with the required absorption of 12 to 15 lbs. of oil, ranges from 40 to 50 cents per tie, while ties treated according to the best German Specifications would in this country cost from 90 cents to $1.00.

Experience seems to indicate that timber treated with creosote oil is in no way softened by the process, if it is allowed to dry thoroughly before being put into service. This conclusion was arrived at in observing that the flange wear on ties without plates was no greater on treated than on untreated ties, and again spikes were driven with no more ease.

2. BURNETTIZING.

This process commonly known as the "Zinc Chloride Process" consists in impregnating the ties with a solution of zinc chloride which is made by dissolving metallic zinc in Hydro-chloric acid, the methods of operation being similar to those in the creosoting process described above. This process has been extensively used in Europe for the past 50 years, and on some of the Western roads in this country and has been eminently successful. The cost of treatment is much less than in the creosoting process varying from ten to twenty cents per tie in round numbers, depending on the time consumed in treatment and the amount of zinc chloride forced into the tie. This process is comparatively cheap and will

lengthen the life of the tie from four to seven years. It is however, from a point of economy successful, only when the ties are to be used in a dry climate where rain is infrequent and the roadbed nearly always dry. This is due to the extreme solubility of the zinc chloride which in wet weather soon leaches out from the tie, thus leaving the surface exposed to decay as before treatment. There is also a possibility of the zinc chloride becoming oxidized by the presence of certain chemical ingredients which are often found in the ballast. Oxide of zinc is not antiseptic and consequently of no value as a preservative.

Chloride of Zinc has the property of hardening the wood, not however increasing its toughness but tending to destroy its elasticity and to make it brittle. This process recommends itself where the first cost of tie is little, and where a consequent increase of five or six years in the life of the tie of poor quality will warrant its treatment at a comparatively little cost. As has been stated ties treated in this manner should be placed only where the climate is comparatively dry, as roads in the West and Southwest. To overcome this extreme solubility of the antiseptic zinc salt, and render Burnettized ties economically available for wet localities, has given rise to a modification of the above process, or rather an addition to it, which in many instances has been adopted by roads formerly using the straight zinc chloride process. This process is known as the:—

2a. WELLHOUSE OR ZINC TANNIN PROCESS.

In this treatment the zinc chloride is mixed with a small amount of dissolved glue. The ties treated in this solution are subsequently put into a solution of tannin and kept under a pressure of about 100 lbs. to the square inch for an hour. The tannin combined with the glue forming a tough leathery waterproof substance, which permanently closes the outer pores of the wood, keeping out the damp and retaining the zinc. The additional cost of this treatment over the straight zinc chloride process is only two or three cents per tie, and the tie is expected to last ten or twelve years longer for the treatment.

Another combination treatment which may be mentioned in this connection is the zinc creosote process, which consists in first treating the tie with the creosote oil in the ordinary manner and afterwards with the zinc chloride solution. The claim being that this latter solution will penetrate into the inner cells of the woods which the oil fails to reach.

3. KYANIZING.

Consists in steeping the ties in a solution of Bichloride of Mercury (Corrosive Sublimate), which is a rank poison and consequently requires to be handled with great care. This solution is one of the best antiseptics known and timber treated in this manner is safe against the inroads of plant and animal organisms. This process hardens the wood but is found in general to be more satisfactory for timber to be placed into dry positions than for ties laid in ballast.

4. VULCANIZING.

This process consists in heating the ties in a cylinder to a temperature of 300 to 500, under a pressure of 100 to 175 pounds to the square inch. This treatment it is claimed changes the chemical condition of the sap into a preservative composition. It has been mainly applied to yellow pine ties at a cost of about 25 cents a piece for treatment. There is no knowledge of the chemical structure of wood sufficient to sustain the claim of the chemical changes, nor has timber so treated been long enough in use to prove the value of this process.

5. SULPHATE PROCESSES.

A "Boucherie Process."—This treatment consists in impregnating the timber in a solution of Sulphate of Copper which is forced into the tie by pressure or vacuum. It is said that this solution is easily decomposed by contact with iron. Railroad spikes and rails will of course bring about decomposition which give rise to free Sulphuric Acid which attacks and softens the wood fibres, weakening the tie. In Europe, however, this process is said to lengthen the life of pine ties from seven to fourteen years.

B—"Thilmany Process."—This process consists first in impregnating the tie in a solution of Sulphate of Copper (or Zinc), and then with a solution of Chloride of Barium, forming an insoluble salt, Sulphate of Baria and the antiseptic Chloride of Copper (or Zinc). Tests made on various kinds of wood seem to indicate that there is a decided loss of strength by this treatment.

C—"Hasselman Process."—This process is one more or less recently put on the market by the Barschall Impregnating Company, works at Perth Amboy, N. J. Their treatment of the timber being with a solution of sulphate salts of Iron, Copper, and Aluminum, their claim being that these salts enter into the chemical combination of the wood, being to quote from their pamphlet, "Chemically bound to the woody fibres." No data whatsoever will substantiate this claim either by chemical analysis or by results from actual experience with timber treated in this manner are forthcoming.

6. Besides the above mentioned processes there have been from time to time numerous other preservative solutions put on the market deserving of more or less merit no doubt but far too numerous to be taken up in this paper.

In conclusion it may be stated that the best evidence at hand to-day places Creosoting at the head of the list of processes of the artificial preservation of timber. The greater cost of treating ties by this process over that of the Zinc Chloride process often precludes its adoption while the latter process is available and economical though less efficient as a preservative.

Quoting from the report of Walter W. Curtis, on "The Artificial Preservation of Railroad ties by the use of Zinc Chloride" presented to the Amer. Soc. C. E. in May, 1899, is the following under "Recent American Experience."

"The Atchison, Topeka & Santa Fe Railroad Officials after twelve years of trial on a large scale, (Burnettizing Process) believe that they are getting from eleven to twelve years service from mountain pine ties having a natural life of about four years; while from natural white oak they get but six years in heavy main line service; and from cedar ties ten years under light service." "The Southern Pacific Railroad, operating on the most perishable material, with a life of only three years at best had 93% of the ties treated and laid in 1899 still in the track after eight years service." Quoting from the "Organ of Progress of Railroads" Series of 1897, published in Weisbaden, Germany, Mr. Curtis gives the following table showing the average life of ties on German Railroads for Zinc treatment and also with Tar Oil (creosoted).

Kind	Life treated with Zinc Chloride.	Life treated with Creosote.
Oak	15 years	24 years
Beech	9 years	30 years
Pine	12 years	20 years

This Committee will not attempt to go into the question of the critical point where it is better economy to use treated ties at a greater cost and longer life in place of the untreated article; but for much interesting information and discussion on this subject would refer to the report of Mr. Curtis above mentioned.

Regarding Belts and Dressings

After a belt has been in use some time, its surface takes on a glaze. This results in losses due to slipping, always accompanied by heating, and draws the natural oils to the surface, causing them to evaporate. This condition lessens the angle of wrap (the angle between the extreme points touched and covered by the belt on the pulley).

Without attention belts are almost sure to deteriorate as above described. Their efficiency is increased and their life lengthened according to the treatment they receive. To prevent the formation of surface glaze and the slipping accompanying it, it is the best practice to use a reliable belt dressing. This dressing should be of a nature that will not only offer temporary relief, but that will penetrate through the surface of the belt and replenish the natural oils. This will result in keeping the belt pliable and preserving the original efficiency.

Rosin is very frequently applied to prevent slipping, and this it will do, but at the same time it destroys the life of the belt itself. You get a temporary cure, but greatly shorten the life of the belt—the rosin dries out the belt and makes brittle the leather fibers.

Dixon's Traction Belt Dressing has through long service proved its value in preserving belts at high efficiency. It does not supply a surface stickiness but is absorbed by the belt, thus keeping it in its natural condition, preventing the formation of surface glaze with the attendant slipping, and maintaining the angle of wrap at its widest points.

If any readers have belt troubles or wish to insure themselves against these troubles, they should take up this matter of the proper care of belts with the Joseph Dixon Crucible Company of Jersey City, N. J.

Surprise and Efficiency Tests of Those Charged with Operation of Trains*

By Frederick C. Syze.

I beg to preface my paper by quoting a paragraph from the "Report of the Committee on Safety Signals, Presented to the General Railroad Convention, Held at the St. Nicholas Hotel, New York, October 24, 1866," and signed by Ashbel Welch, Chairman:

"Nothing that tends to increase the safety of railroads is unimportant. Besides the moral obligation to protect life and limb, very large interests of the Railroad Companies are at stake. Much of the hostility, sometimes shown by the public, against these companies, is owing to their supposed recklessness. It is much better to spend money in precautions than to pay it in damages."

With this text in mind I have been possessed with the temerity to hope that even my feeble efforts in writing on this subject might be indulgently classed among those that are not altogether "unimportant"; and if I shall have in the slightest degree stimulated a new interest in this most important branch of the science of railroading I shall feel amply rewarded for my endeavors to present the subject in a somewhat different light.

The railway is a commercial institution whose utter failure of operation no less a person than Daniel Webster confidently predicted; but it is very patent to the present generation that what was at first a dubious experiment is now the most pressing necessity of commercial life. The science of railroading has attained proportions of the most gigantic and wide-spread world-movement history has ever recorded; it does not now belong to any one age, but henceforth to all ages. We should therefore strive not only to see it as it appears today, but to see it in its relation to yesterday and tomorrow.

If, during the transition from the local to the universal in methods of operation,—from the hand-made to the machine-made and from the small shop to the gigantic producing-plant, so to speak;—from the struggles with many railways contracted before they were warranted to the time when their nurses could trust them to walk alone, or place them under the protection of a strong and healthy guardian; from the individual idea to the accepted standards,—if, I say, during this confusion of ideas, and then the final rush to keep pace with the greatest growth and pressure of industrialism the world has ever known, there

*From a paper read before the New York Railroad Club.

has not in many instances seemed to have been the necessary means and opportunity to devote to the subject of absolute safety of operation, it is well within the truth to say that all indications now point to a deeper and more concerted interest in this direction than has ever before been manifested. The transition seems to be about completed.

With the advent of the Signal Engineer the dawn of the millenium of safe operation is at hand. Before many young men now struggling with these problems pass them on to their successors the railway collision will be so rare as to cause as much consternation as did the first one. It is the rightful reward of this age, which produced the railway, to point out the methods for safely operating it, even if it cannot perfect those methods.

If there was such a pressing necessity for safety devices half a century ago, how great must be that necessity today! One has a natural curiosity to see statistics of railway accidents for the period of which Mr. Welch writes, that we may be enabled to view the subject in its proper relation to like statistics for the present decade; but my efforts to obtain figures further back than 1888 were futile, the Interstate Commerce Commission having nothing of value on such matters which ante-dated its creation.

It will be seen that in the twenty-two years just ended more than 1,334,940 persons were killed and injured on the railways of the United States, this total not including "Other Persons" killed and injured during the last two years. Figured down a little closer it means that some person has been killed or injured in about every eight and a half minutes, day and night, all during this more than a fifth of a century. These figures include, of course, all cases of accidents—collisions, derailments, parting of trains, coupling and uncoupling cars, jumping on and off trains and cars, struck by trains, locomotive and cars at highway crossings, at stations, in yards and other points along the line, etc., etc. We frequently attempt to console ourselves with the thought that while the number of passengers killed and injured might at first blush seem quite large, yet during the year 1900, for instance, when our showing was at its best for the decade beginning with 1897, we carried 2,316,591 passengers safely for every one killed, and 139,736 safely for every one injured. But when we find that during the same year in England the proportion was one passenger killed to every 8,461,309 carried, and one injured to every 470,848 carried, the shock to our consoling feelings is very acute, particularly when we stop to consider that there has been a tendency in many quarters of our country to poke fun at the lack of progressiveness and activity in our English cousins. While it is commendable to strive to excel, our excellence in this particular matter does not lend very much éclat to our prowess. I find it is also true that on the continent of Europe an even better showing than that of England was made in the same period. Below will be found a table showing the ratios of total numbers carried to one killed, and to one injured, for the eleven years prior to and including 1907, in the United States.

Year.	Number of employes for one. Killed.	Injured.	Number of trainmen for one. Killed.	Injured.	Number of Passengers for one. Killed.	Injured.
1907	369	19	125	8	1,432,631	67,012
1906	387	20	124	8	2,222,691	74,731
1905	411	21	133	9	1,375,856	70,655
1904	457	19	120	9	1,622,267	78,523
1903	364	22	123	10	1,957,441	84,424
1902	401	24	135	10	1,883,706	97,244
1901	400	26	136	13	2,153,469	121,748
1900	399	26	137	11	2,316,591	139,736
1899	420	27	155	11	2,189,023	151,998
1898	447	28	150	11	2,267,270	170,141
1897	486	30	165	12	2,204,708	175,115

Even a glance at this table impresses one very forcibly with the fact that notwithstanding that the greatest period of development of safety appliances was contemporaneous with these figures, the showing at the end is worse than at the beginning. The American people are ever ready to extend their sympathy and succor to all parts of the world where distress and horror are rife, but a few comparisons of the great horrors of history since about 1800 with the tables shown above indicate that perhaps we are the ones in need of a little sympathy when viewed from the outside world.

In the great conflict at Austerlitz, the losses on both sides in killed and wounded were 42,800; at Borodino, which is styled the "bloodiest battle of the century," the losses on both sides were between 70,000 and 80,000; and in the famous battle of Waterloo, which always fascinates us, and which stands out as one of the monuments of history, there were 53,428 soldiers killed and wounded in both the French and the Allies' armies. The total number of Federal soldiers in service during the Civil War was 2,666,999, and in the Confederate army about 500,000. (On June 30, 1907, there were 1,672,074 persons employed on the railroads of the United States.) The Federal soldiers killed in action or died of wounds during the war numbered 110,070, and 249,458 died of disease and other causes, a total of 359,528 casualties; and the total losses in both killed and wounded in the Confederate army is estimated at 95,000 making a grand total of 454,528. For a like period of four years—1904 to 1907, inclusive—there were killed and injured on American railroads 421,091 persons. Coming down to the world's greatest battle—that of Mukden in the recent Russo-Japanese war—the aggregate losses in killed and wounded on both sides are estimated at 100,000. The worst earthquake calamity ever visited upon any civilized country—that which befell the territory around Messina last winter—numbered about 125,000 victims according to the estimates of government officials. During only one fiscal year ending June 30, 1907, it will be seen that 122,855 persons were killed and injured on our railways.

But in all the conflicts mentioned there was a principle at stake which was thought to be worth the sacrifice of human life; can we offer any such reason or excuse to posterity for our apparent disregard of life and limb in the peaceful and daily operation of a commercial necessity? Here is a paradox indeed: a giant nation whose great heart throbs with kindness, generosity and pity toward all suffering humanity, yet is as careless and

wasteful of its own life and limb as it is of its boundless resources! What is the basic cause?

About a decade before the operation of the first steam railway in England Sir Walter Scott says, in his Heart of Midlothian, that "mail-coach races against mail-coach, and high-flyer against high-flyer, through the most districts of Britain. And in our village alone three post-coaches, and four coaches with men armed and in scarlet cassocks, thundered through the streets each day"; and in speaking further of the casualties of the "outsides" and "insides"—passengers who were thrown off and out of the coaches as they dashed along the mountain roads—he concludes: "But that which gratifies the impatience of the human disposition will be practiced in the teeth of danger and in defiance of admonition." And that's just what's the matter with the American people. A careful diagnosis of their anatomy will probably reveal one of the most malignant cases of "impatience of the human disposition" on record. Wherefore all this great hurry? Where are we going, and what shall we do after we get there? When shall we begin to slow down to a strong steady pace? There is a happy medium between indifferent-progressiveness and ultra-progressiveness which a very large proportion of the American people have been very slow to hit upon. They must do everything with a rush and vigor out of all proportion to the requirements of the proposition in hand, or lose interest in it. As it is the fault of the majority of ambitious young men to bear down too hard, thereby wasting much strength and making many false steps, so must it be true of a strong young nation; for as the individual citizen is, so will the nation be. We seem to want to do everything in our own day and generation and not to leave anything for future generations, so strong is the hold upon us to act as pace-makers; with the natural result that many things are attempted and not a very high percentage done in a permanent and thorough-going manner. We cannot but regret having had many make-shift and superficial methods in important matters, and having done many things merely to conciliate the present moment. It would seem that in too many instances very little heed has been paid the homely old adage, "once well done is twice done." Periods of experimentation must not, however, be overlooked or disparaged.

It is but natural that this aggressiveness, this freedom of individual action, this casting of all restraint to the winds, this propensity for taking chances—this "Americanism" if you will—should have its disastrous effect upon the operation of so complicated an institution as the railway. Environment exerts a far-reaching influence. We therefore reach the natural deduction that practically all the disastrous collisions, and many of the derailments, are due to two causes: Disobedience and Recklessness.

It is hardly necessary to call special attention to the very high percentage of serious collisions caused by the "mishandling of train-orders," as the figures stand out so glaringly as to shake our faith in this time-honored method of operation. After a trial of half a century with this system, can we say it is any safer today than at its inception? Hedge the system about with all the safeguards conceivable as we will, there are still crevices innumerable in it where "personal equation" slips in and—the collision. Even by conceding that the train dispatcher is infallible the figures clearly show that the system breaks down after the orders leave his hands; could he personally control them to their fulfillment the showing would be much better. Before the days of the great industrial pressure, when lines were not too crowded with trains as they are now; when the train dispatcher was a more important official than he is today; when the personnel in the telegraph offices was made up largely of men enthusiastic in their work because such positions at that time attracted men of ability—men who have since become the managing officials—the train-order system, barring the double-order feature, was probably at its best. The train dispatchers of those days were continually putting out reminders and hints here and there and keeping in closer touch with the trains they were moving toward each other than is perhaps possible with the greater traffic in the present period.

There are cases, too, where the present-day dispatcher feels that the modern system will work almost automatically, and that after the order leaves his hands it is "up to the other fellow." We can not dispute his technical right to assume this view-point, but not a few collisions would undoubtedly have been averted had he thrown out the safeguards in critical situations that "the masters" did. I say "the masters" with the deepest sincerity and deference, for after over twenty years' experience in the handling of train-orders as operator and dispatcher I still feel my inferiority to many of the sturdy generals of the art who passed up to higher positions over a quarter of a century ago. One of them—Mr. Frank S. Gannon—said to me, when I was promoted to train dispatcher on his line: "Young man, always figure on some engineer, conductor or operator doing some foolish thing with a train-order that he has no business to do." And while it is admittedly impossible to pack more and better advice in so few words, they themselves unconsciously betray the greatest weakness of the system. I have profited much by this sound advice. Severe self-criticism has taught me that I was no better, and perhaps no worse, than the average modern dispatcher.

While the train order will no doubt be used for many years on most railroads, and perhaps for a seemingly indefinite period on lines of light traffic, I feel that the Signal Engineer will more and more do its work, until on all important lines, its supersession, as we know the train-order system today will take place. But until it does take place, we must accept it as it is, and subject its handling to the most strict and rigid supervision possible.

When any one criticises a condition, or knocks down something that has been built up, I believe it is the opinion of all fair-minded men to expect him to suggest better or be very deservedly relegated to the limbo of the cynic, the iconoclast, or the misanthrope. What I have said in

the foregoing has not been so much in the spirit of criticism as in an endeavor to describe conditions as they exist, without regard to any personal considerations. As a cure for many of the evils in our railway operation I beg to emphasize the following practices, practically all of which have in whole or in part been adopted on many lines.

First (and most important): As rapid an extension of block signal systems as possible. Do everything conceivable and reasonable to make the operation of trains "visual," thereby reducing the chances of "personal equation" to a minimum, and leaving as little to the memory as possible. To quote Mr. Welch again: "It is much better to spend money in precautions than to pay it in damages." During the six years ending March 31, 1909, collisions cost American roads $14,350,790 in damage to equipment and roadway alone, say nothing of the losses on account of deaths and injuries, or of the grief and suffering incident thereto. Even in staid old England, where the signalman and the manual block signal systems have perhaps attained the highest degree of efficiency, less and less is being left to "personal equation"; and in many cases, even though no collisions have occurred to warrant it so far as we know, electric-control apparatus has been installed" by which men at the opposite ends of a block must co-operate in giving a clear signal." While the comparative lightness of traffic is said by many to account for the very gratifying decrease in casualties during 1908-9, I shall, for the moment, usurp the professional politician's prerogative of "claiming everything in sight," namely, that this decrease is due solely to safety signals and "surprise" tests. Why should we, who pride ourselves on our ingenuity, and ability to quickly and squarely front all conceivable conditions, be compelled to resent to the excuse of "dense traffic" when pressed for reasons for so many casualties? Officers "at the front" know very well that no matter how dense the traffic is—and the more dense it is the better many of them like it—it can be handled just as safely as light traffic can be—with modern applications and "everybody on the job."

Second: Improve the personnel of the train service to the highest possible degree. On every application blank of the Baltimore and Ohio Railroad is printed:

"There are three ways to improve the character of the service:

1. Employ a better class of men.
2. Discharge the vicious and incompetent.
3. Educate those kept.

So far as possible men should be employed from those living along the line of the road. Their moral character, physical fitness, mental capacity and past record should be rigidly examined.

ONLY THE BEST SHOULD BE EMPLOYED.

Experience teaches that these things, like many others, are more easily said than done; but the fact remains that if they are perseveringly and determinedly adhered to, the best of results are ultimately bound to ensue. During periods of dense traffic there is no doubt that many men found employment on railroads who, under normal conditions, would not have been considered. I place great faith in the belief that there are enough clean, ambitious and able young men in this country who will be attracted to the railroads, to man them so efficiently that within the next decade or two the "vicious" and "incompetent" elements will be negligible, provided, however, that the policy outlined above is persistently followed.

Third: The systematic and unceasing Surprise and Efficiency tests of those charged with the operation of trains. This in itself takes on a very high educational value when carried on in a broad-minded manner stripped of all intentions to hound or persecute the men concerned.

The terms "Efficiency" and "Surprise" tests are of comparatively recent origin, having been employed on only a few roads within the last decade, and on many others within a still more recent period; on still others not at all. While the terms are new, the practice is nothing more nor less than systematizing the inspections and supervisions always carried on by able officers. Twenty-five or more years ago even officers with titles of Superintendent and upwards did a great deal of this work themselves, and came into a closer contact with their men than is now possible; therefore the education and supervision must now necessarily be delegated to subordinate officers. This is but another logical step in the transitory period previously referred to. As—

"In every new lives all the old,
The present builds on all pasts' mold,"

so this system of tests is simply another of those reforms, or readjustments to changing conditions, that must from time to time be made in any wholesome and progressive institution. Twenty-odd years ago I heard a prominent railway manager say that a few years before that time there had been no mishaps in such a long period on the property he was then managing that the tension became very great from the fear that when something did happen it would be of a very serious nature. To forestall the possibility of lax practices creeping in during so long a peaceful interval, he accordingly issued a cautionary bulletin to all concerned to tighten up on the rules in every manner possible. This, in a certain sense, could well be classed as a "surprise" test, as it embraces the spirit of present-day practices.

Lumber Prices

A record of the wholesale prices of lumber f. o. b. mill for the quarter including April, May and June, last, based on reports submitted by more than 2,000 of the largest manufacturers of lumber in all parts of the country, has been issued by the United States Forest Service. Requests for data for the second quarter, ending September 30, will be sent out in several weeks, and will be published in the early part of October.

The record covers the principal items of all the commercial woods cut in nearly every state. The compilation was undertaken for the double purpose of having a continuous statistical record of such prices

and to show, in contrast to market prices—which include the important items of freight charges and selling costs—just what the manufacturers of lumber receive for their product at the mill.

For more than a year a monthly record has been compiled showing the prices of lumber in 18 of the largest markets of the country. The market prices published do not show what the lumber is worth at the mill, as the freight charges, selling costs and other items were included, but the quarterly record eliminates these items and shows the mill price. Only a few representative grades in each of the hardwoods and softwoods were taken, but from them lumbermen can draw deductions so as to give the approximate values of grades on which prices were not requested. In addition to their numerous items on which prices were secured, the value of the mill-run—the average of all grades of lumber produced—was also obtained for all the commercial woods.

New Forest Experiment Stations

The government is now carrying on investigative work at regular forest experiment stations similar to the agricultural experiment stations in the different states.

The first forest experiment station created in this country was the Coconino Experiment Station at Flagstaff, Ariz., established last summer. Investigations covering many phases of forestry in the southwest have already been undertaken at this station. The second forest experiment station has been established this year on Pike's Peak, Colorado.

The need for such stations becomes apparent when the long time necessary for handling forest experiments is considered. In agricultural experiments definite results can usually be obtained in one or at most a few years; in forestry, because of the long time required for trees to develop, scores of years are often required to complete a single experiment.

All experimental work is conducted under the direction of men who have had thorough training in technical and practical forestry. Every experiment has a direct bearing upon some problem which vitally concerns the management of the forest. Every experiment will be pursued until conclusive results are obtained and every man conducting investigative work will be given an opportunity to put his recommendations to the test in actual field work. Under this system every new plan can be thoroughly tried before being put into practice on a large scale, and thus the injury resulting from mistaken practices can be minimized.

The greatest technical problem which now confronts the forester in handling the great pine forests of Arizona and New Mexico is that of establishing a new stand of trees to replace the old timber which is cut off. This was the first problem undertaken by the Coconino Experiment Station. Much valuable information regarding the factors influencing natural reproduction has already been secured, but many years of systematic study will be required to fully solve the problem. The feasibility of artificial regeneration by planting and sowing is also being tested. The latter experiments, for the sake of economy, are being conducted on the smallest scale which will insure reliable results applicable to general conditions.

The plans for the near future provide for a detailed study of the problems concerning the natural and artificial regeneration of other commercial trees such as Douglas fir, Engelmann spruce and the junipers.

Tests will be made of trees introduced from other regions, with the view of finding other species, adapted to planting in this region, which are superior to the native trees.

One important problem which will occupy much attention at the experiment station for a number of years is the determination of the rate of growth of immature trees left on an area after logging. In scientific forestry, as practiced in many European countries, every tract of timber is so handled as to yield a perpetual supply of material, harvested at regular intervals.

In order to establish such a system of management, it is necessary to know for each area logged how soon it is practicable to return for a second cut, and the yield which can be expected at that time; and in order to do this, it is necessary to determine how fast trees of different ages grow after the mature timber has been removed. These data will be secured by periodic measurements of all trees on typical cut-over areas on different forests in Arizona and New Mexico. During the present season experiments to determine the influence of thinning upon the rate of growth and the quality of timber produced by the remaining trees will be initiated.

Attention is also being given to the improvement of the range. An attempt will be made to introduce valuable forage plants on portions of the range on which the native vegetation is sparse or of an inferior quality. Experimental sowings of Kentucky blue grass, timothy, red top and brome grass have already been made, and other forage plants will be tested from time to time. A collection is being made of all herbs, shrubs and trees found on the National forests, together with notes on their forage or wood producing value.

Colon Passenger Station

The new terminal passenger station of the Panama Railroad Company at Colon was opened on Friday, July 23. It is located on Front street, between Seventh and Ninth streets, about midway between the old Colon and Cristobal stations, and extends over the greater part of two blocks, with the main entrance on Eighth street. The structure consists of the station proper, 19 feet by 442 feet, 22 feet high, with a tower at Eighth street, 20 feet by 40 feet, 43 feet high; a covered platform 20 feet by 720 feet, and an open platform 10 feet by 700 feet. Ten feet of the 20-foot covered platform for its entire length, 720 feet, and 420 feet of the 10-foot open platform, together with 1,140 feet of track, are enclosed by an 8-foot iron

picket fence, providing room within the enclosure for a train consisting of an engine and fifteen 70-foot coaches. A picket gate at each end of this enclosed train yard controls the entrance and exit of trains. Passengers alighting from trains reach the station or street through turnstile exits in the fence, and passengers boarding trains enter from the station through four gates, where their tickets are punched by gate tenders.

In general, the style of architecture is old English, the type being pronounced in the castellated battlements which crown the cornice at both ends of the building, and in the center of the south and longest section. The construction is permanent throughout. The tower, including the interior arches, is of reinforced concrete. The walls of the main building are made of concrete blocks 9 inches high, 31 inches long, and 12 inches wide, resting on a concrete foundation and wall four feet high. The roof of the building proper is arched, being built of semicircular steel trusses and steel purlines. The dome in the tower consists of a half-cylinder with axis parallel to that of the station and intersected at right angles at each end by a quarter-cylinder of the same diameter. The cornice work and trimmings throughout are of concrete. The total floor space within the station proper is 7,375 square feet. Lettered on the frieze of the main facade are the words "Panama Railroad Company," and in the center underneath, the year "1909."

The street entrance for passengers consists of two arched openings, 9 feet wide and 19 feet high, leading to the vestibule, 20 feet by 40 feet, located in the base of the tower. The south entrance is for first-class and the north entrance for second-class passengers. In the vestibule, on the side next to the track, is the ticket office, the approach to which is guarded by iron railing regulating the movements of first and second-class passengers. In the southeast corner of the room is an office for the sale of steamship tickets. The news stand will occupy a space between the two main entrances.

Passenger trains are made up on the Panama Railroad with first-class coaches in front and second-class in the rear. On outgoing trains, this places the first-class coaches at the south end of the train. The waiting room for first-class passengers was therefore located south of the entrance, so as to be nearest to that part of the train, while on incoming trains, passengers in the first-class coaches will detrain close to the carriage exits.

Both the first-class and second-class waiting rooms are connected with the vestibule by high arched entrances. Both waiting rooms are identical in size, 45 feet by 17 feet, and both have ample toilet accommodations. The first-class waiting room contains one single and three double high-backed seats, accommodating 40 persons, while the room for second-class passengers contains one single and five double seats. The rooms are well lighted, there being eight windows on the street side in the first-class, and nine in the second-class. The walls in these rooms, as well as in the vestibule, are kalsomined a shade of blue, with a dark brown base border.

The baggage room is 197 feet 6 inches long, and occupies the south end of the depot. A commodious locker is located in one end for express and other valuable packages, and there is a long row of shelving on each side for hand baggage and parcels. Two double sliding doors open on the station platform. Business with the general public is transacted through a counter window, 15 feet long, about midway of the room. The baggage section is lighted by 20 windows on the street side, two at the south end, and 14 on the track side. The north portion of the station is occupied by the Central & South American Cable Company, who have a space 88 feet long.

The station platform is of concrete construction, 20 feet wide, and extends a distance of 720 feet, or from Seventh street to Ninth street. The roof of the platform is of "butterfly" type, commonly used in train shed construction, the eaves being uptilted at an angle of 21 degrees. This is to prevent dripping from the eaves, the water during rains wasting into a gutter in the center of the roof. From the south end of the station platform, a 10-foot concrete walk continues all the way to the Eleventh street crossing at Cristobal, and will serve to divert a portion of the foot traffic from the crowded east side of Front street. Entrance to the train shed is through four gates in the picket fence, directly opposite the Eighth street entrances, while exits are made through six turnstiles, three double turnstiles near the north end of the station opening on the carriage yard, one at the end of the passenger shed at Seventh street, one opening on Sixth street, and a single turnstile at the end of the picket fence enclosure near Fifth street.

The track space in the train yard is 14 feet wide, and is separated from the two freight tracks on the west by the 8-foot iron picket fence mentioned above, which also encloses 10 feet of the platform.

The space allotted to carriages occupies a recess in the curb lines at the north end of the station, near Seventh street, and is 28 by 183 feet. The cart yard is located at the south end, near Ninth street, convenient to the baggage room, and occupies a similar recess, 18 feet by 100 feet. An agreement has been reached between the municipal authorities of Colon and the Panama Railroad Company, whereby traffic on Front street will only be allowed to move northward. All carts and vehicles going southward must use Bolivar street, or Bottle Alley, and if they have business on Front street they must reach their destination by one of the cross streets.

The station is lighted by 115 Tungsten electric lamps, 25-watt. On the outside, above the lettering on the main facade, there is a row of 26 lights, 18 inches apart, running along the cornice. Around the inside of the vestibule there is a similar row. The station platform is lighted by 23 lights, six of which burn all night.—The Canal Record.

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Wood Preservation

Interest in the preservative treatment of timber to increase its length of life is developing at a rapid rate throughout the northwestern states. A few years ago when all kinds of wood were cheap and plentiful, people selected the kinds which were most durable and best suited for their purposes. The result is that the most valuable species are nowadays comparatively scarce and high, and the cost of wood has become a big item particularly to farmers, railroads, mines, and telephone companies. The men controlling these industries naturally began to cast about for some means of reducing the cost of fence-posts, piling, railroad ties, mine timbers, telephone and telegraph poles, and other timbers likely to decay, and making them last longer. The thought naturally occurred: "If there were some way to make the common and cheap kinds of timber last longer, it might help some." Various people got busy and worked out several different methods of treating timber cheaply and yet effectively. Probably the United States Government, through the Forest Service, has worked on this longer than anyone else in this country. Now the processes have been so well developed that the economy of timber treatment is a sure thing. The life of almost any wood can at least be doubled by thorough impregnation with creosote or zinc chloride. This alone means a great saving, both in the orignal cost of the timbers and in the labor of replacing them. But better yet, cheap woods when well treated are just as good as the valuable and naturally durable kinds, and will last considerably longer than those which are naturally durable but untreated. Then cottonwood, willow, spruce, lodgepole pine, or jack pine can be used in place of cedar for posts; birch, hemlock, or tamarack in place of oak for ties; lodgepole pine in place of cedar for poles; and in every case the treated substitute will last longer than the wood commonly used, and will cost less.

The railroads, always alert for greater economy in management, were the first to adopt preservative treatment for their ties. The Northern Pacific now creostes nearly every tie used. Its two creosoting plants at Brainard, Minnesota, and Paradise, Montana, are runnig to their full capacity and using any species of wood. The Great Northern operates a large plant at Somers, Montana, where it uses zinc chloride instead of creosote. Two new plants will be erected very soon by the Great Northern, one at Cass Lake, Minnesota, and another near the western end of the line, in Washington. The new transcontinental road, the Chicago, Milwaukee & Puget Sound, is also planning to build a very large treating plant in Montana within a short time.

The large mining companies are not far behind the railroads in adopting preservative treatment for the timber used in the mines, as enormous quantities of timber are used each year for supports. While a great deal of this is temporary in character, there are many tunnels and shafts which must be kept open for a long term of years. Here where wood decays very rapidly, and the cost of replacing the timbers is very great, a good deal of money can be saved by treating the timber with a preservative. The Bunker Hill & Sullivan Mining & Concentrating Company of Kellogg, Idaho, and the Hercules Mining Company, of Burke, Idaho, last year obtained the assistance of the Forest Service in designing and building treating plants. The Forest Service furnished an engineer in wood preservation to take charge of the plants until employes of the companies had become familiar with the work, the companies paying the expenses. After six months' operation under the supervision of the Forest Service, the latter withdrew and the plants are now being run by the companies themselves.

Any person who so desires can obtain similar cooperation with the service by application to the District Forester at Missoula, Montana.

Conservation of Yellow Pine

The interest being taken by practical lumbermen in the conservation of the forests was illustrated at the semi-annual meeting of the Yellow Pine Manufacturers' Association which was recently held in Chicago. The report of the committee on the conservation of the yellow pine forests received much attention and was adopted unanimously.

Among the chief recommendations made by the committee in its report was for the cutting by lumbermen of their timber by two operations with an interval of from fifteen to twenty years, the ripe timber being removed during the first cutting and to leave from 2,500 to 3,000 feet of standing timber on each acre. It was shown by such a method of lumbering that a decided advantage would accrue to the lumbermen through the increased growth and consequent gain in timber which would be had between the first and second cuttings.

The Association also adopted the recommendation of the committee providing for the appointment of a committee with power to act and to expend funds to co-operate with the Forest Service on matters of education, forest fires, and taxation.

Fire Protection

To determine the efficiency of its own system of fire protection, the Pennsylvania Railroad has undertaken a thorough test of its fire-fighting facilities in Altoona, where there has just been finished a new and unique high-pressure water system, for fire protection purposes only, and without connections with any other distribution pipes.

That it is of great importance that this system should have been developed may be realized in the fact that a conflagration in Altoona would seriously interfere with the operation of the entire Pennsylvania System, because Altoona is the mechanical center of it. Besides, the insurable value of the machine and car shops at Altoona, with the equipment in adjacent yards, is more than $6,000,000.00; not to speak of the large Juniata shops, where the company builds many of its locomotives.

Gridironing the expensive machine and car shops at Altoona are more than 7 miles of large water mains, with 72 two and three-way hydrants, supplying 184 streams of water. These afforded a protection, which from exhaustive tests, has been shown to make very remote the possibility of a serious fire.

In addition to two fire engine companies, chemical extinguishers are distributed through the shops, while sand and water pails, hose racks, chemical engines, water casks and ladders add to the equipment with which these railroad fire fighters are armed. Some 31,000 ft. of cotton rubber-lined hose are available for utilizing the water from the hydrants, which, owing to the unique arrangement of the mains, and valves cannot be shut off from their water supply by breaks in the pipe lines.

To guard against breakages in the mains, clogs from mud, and similar troubles experienced so frequently by municipal fire departments, the company has, in its system of fire protection, adopted the method of laying parallel mains under its shops and equipment yards, so that by the use of gate valves, any part of a broken main can be cut off to itself, and in no way interfere with the flow of water to the different hydrants.

On account of the congested areas in the mchine shops, the railroad has found it necessary to erect four-story buildings. These structures are more than 100 ft. high, and an important part of the test was to determine if the recently installed high-pressure system would throw a stream of water on the top of these buildings. By the use of what is known as a "deluge set"—which is nothing more than two lines of hose siamesed at one nozzle—a two-inch stream of water of 400 gallons a minute was thrown on the top of the machine shops.

A further unique feature of the Altoona fire system is that by means of a reservoir in the Pottsgrove Hills, back of Altoona, there have been dammed some 180,000,000 gallons of water, which, even in event of a severe drought, will be available for fire fighting purposes. The high elevation of the reservoir gives to the system a static pressure which cannot be interrupted by a break down of a pumping station or fire engine.

In the same way as at Altoona has the Pennsyvania Railroad established its fire protection at every large and small terminal and station. At the more important points, such as New York, Jersey City, Philadelphia, Pittsburg and Baltimore, systems proportionately as elaborate have been installed to protect the property of the company. Net works of fire mains with plugs at convenient places, make it very unlikely that the company will suffer serious loss from fire.

At the test in Altoona, a number of suppositious fires were started in different parts of the railroad shops, and firemen, with their helpers responded to fight imaginary flames. Some 32 regular firemen, and a score or more of the auxiliary force directed the streams of water, while inspectors checked up the results.

To make the test thorough, seventeen streams were brought into service. At intervals of two minutes, streams were turned on, and, after all of them were throwing water on the buildings, readings were taken of the pressures. The test continued for one hour and a half, during which time some 185,000 gallons of water were used.

Not only have these exhaustive precautions been taken at Altoona, but in the realization that fires are liable at any time to occur at places which cannot be reached by ordinary extinguishing apparatus, the Pennsylvania has equipped 423 locomotives with fire fighting apparatus. These locomotives are used continually in yard service at various points on the company's lines and are available at all hours of the day and night. On a given signal, their crews, all of which have been trained in fire fighting, hurry their engines to the scene of the fire, and all tracks are cleared that no time be lost en route. So successful has this method of protecting property at out of the way

places proved, that an additional number of yard engines are being similarly equipped.

Exactly 1,397 fires occurred in 1908 on Pennsylvania Railroad property valued at more than $260,000,000.00. It was damaged only to the extent of $346,149.00. Of these fires, 274 were extinguished by the railroad's employes with the company's own apparatus with slight loss. The redution of its fire loss to such a minimum means that the railroad has had to make it practically impossible for a conflagration to start in its yards and terminals. It has been working to this end for thirty odd years, and today its system of fire protection represents the most extensive and comprehensive undertaking of its kind as yet made by any private corporation.

Long Island Railroad Co.

The Long Island Railroad Company has just resumed work—suspended some time ago—upon the improvements on its line between Fiske Terrace and Manhattan Beach, whereby 14 grade crossings will be removed and the tracks of the Long Island carried for 3.3 miles on an embankment alongside the tracks of the Brighton Beach road to Sheepshead Bay, thence by an independent embankment to a new station to be erected at Manhattan Beach.

Work is also being pushed on the Bay Ridge improvement, a large concrete viaduct having just been completed over First Avenue, Bay Ridge. It is planned by this improvement to remove 45 grade crossings between Bay Ridge and Fresh Pond Road. Before it is completed, the Bay Ridge improvement will have involved the expenditure by the railroad of about $6,500,000, while the city's part of the improvement will have cost $2,500,000.

Up to the present time, the Long Island Railroad has spent approximately $6,000,000 in removing grade crossings in Brooklyn. This included the Atlantic Avenue improvement, toward which the city paid $1,250,000 additional; thus, upon the completion of the Bay Ridge improvement, the Long Island Railroad will have spent within the past ten years approximately $12,500,000, involving grade crossing elimination.

One of the most important undertakings in view for the current summer is the tunnel to be built under the East New York hill just north of Manhattan Junction. This will remove some very dangerous crossings at fourteen streets, and greatly facilitate the movement of trains as well as promote the public convenience.

In spite of all that has been done to eliminate grade crossings in Queens Borough, some 203 crossings at grade still remain. The company itself is prepared to spend $6,000,000 more toward getting rid of these provided the city will continue its former policy of contributing one-half the expense incidental to removing the crossings.

The company would, in addition, make various improvements which would benefit the public and greatly augment the taxable value of the neighboring property. During the last session of the legislature, a bill authorizing the city to share in the expense of removing these crossings in Queens Borough failed of passage. In fact, for the first time in many years the last legislature failed to make any appropriation for continuing the work of grade crossing removing in this state.

There are in New York 10,544 points at which railroad tracks encounter public highways. At 1,698 of these points the crossings at grade have been removed. The protected crossings altogether number 3,676, distributed among the different railroads according to the following percentages: Long Island 51 per cent, New York Central 43 per cent, Delaware, Lackawanna & Western 43 per cent, Erie 31 per cent, Delaware & Hudson 30 per cent, New York, Ontario & Western 30 per cent, and Lehigh Valley 20 per cent.

During the last five years, the different railroads, with the assistance of the state and municipalities, have been actively engaged in reducing the number of grade crossings on their lines by elevating or depressing the tracks. The Long Island Railroad, by having removed 22 per cent of the total number of grade crossings on its lines, leads in the number of crossing eliminated. Grade crossings on the other principal railroads in New York have been abolished in the following proportion: New York Central 20 per cent, New York, Ontario & Western 16 per cent, Delaware, Lackawanna & Western 13 per cent, Erie 13 per cent, Lehigh Valley 12 per cent, and Delaware & Hudson 10 per cent.

Double Tracking and Grade Revision

The Pennsylvania Lines west of Pittsburgh have just started work on some very important double-tracking and grade revision, designed especially to facilitate the movement of traffic on the Pittsburgh, Chicago, Cincinnati & St. Louis Railroad between Columbus and Chicago on the one hand, and between Columbus, Indianapolis and St. Louis on the other.

The first of these undertakings involves the double-tracking of 99 miles between Horatio and Onward. This movement will involve 1,500,000 cubic yards of excavation, and the installation of 25,000 yards of masonry, and the removal of 20 grade crossings. It will also call for the elimination of all facing point switches on this part of the line except those which are interlocked. The maximum grade on this line at the present time is 0.5 of one per cent, but it is designed to decrease this to 0.3 of one per cent.

These improvements have been rendered necessary by the development of the steel plant at Gary, Ind., where a very large amount of coal and coke from the West Virginia coal fields is used. The cost of this undertaking will be about $3,000,000. Grading will

be pushed as rapidly as possible this year and it is expected that the tracks will be in use by the summer of 1910. With the completion of this work the Pennsylvania Lines west of Pittsburg will have an alternative double-track road between Pittsburg and Chicago as the entire line is already double-tracked except betwen these two points, and about 6 miles through Piqua, Ohio.

To facilitate the movement west of Columbus destined for Indianapolis and other points for the Southwest, the 63 miles between Richmond and Irvington, Ind., are to be double-tracked and all grades reduced to a maximum of 0.7 of one per cent, at an estimated cost of $4,000,000. Contracts for two sections of this line have been let already, covering the 17 miles between Richmond and Dublin. These two sections will involve the excavation of 1,187,000 yards of earth, the elimination of 20 highway grade crossings, and the installation of 46,500 yards of masonry.

For the 7 miles between Dunreith and Knightstown, 513,200 yards additional of excavation will have to be taken out and 23,300 yards of masonry will be installed. By this improvement 11 highway grade crossings will be eliminated. It is planned to raise the grade at Cambridge City about 27 feet in order to separate the crossings of the Pennsylvania Lines with the Big Four, and the Lake Erie and Western Railways. The Cambridge City Branch will be abandoned between Cambridge City and Bentonville, a distance of 6.2 miles, and a new line built from Bentonville to a connection with the main line at Dublin, a distance of 5 miles, in order to reduce the ruling southbound grade of the branch.

Except for 6 miles through Piqua and 31 miles between Bradford and New Paris, this work between Richmond and Irvington will complete the double-tracking between Pittsburgh and Indianapolis. On the line between Indianapolis and St. Louis there are now 36 miles of double-track so that for the total distance between New York and St. Louis it will be possible to travel for 817 miles on a railroad having from two to six tracks. It is expected that this will very greatly facilitate the movement of both freight and passenger trains.

New Construction Work

Improvements to cost approximately $1,000,000.00 are to made by the Pennsylvania Railroad at Greensburg, Pa., and bids on the work will be asked. Two additional tracks will be built through Greensburg, a new station will be constructed, a tunnel will be removed, and the grade of one per cent will be cut down one-half.

The Pennsylvania Railroad has practically completed its four-track line from Pittsburg to New York, but at several places there are short stretches of two and three-track road. It is these gaps which are being rapidly removed by the construction of additional tracks. The Pittsburg Division—the line between Pittsburg and Altoona—now has a one-mile stretch of two-track line through Greensburg, a half-mile through Radebaugh, where there is a tunnel, and two miles of three-track line through Sang Hollow. With the completion of the Greensburg improvements, only two and one-half miles of the two and three-track road will remain on the Pittsburg Division of the Main Line.

Heavy westbound passenger trains have for years experienced difficulty in starting from Greensburg station, owing to the steep grade at that point. It was for this reason, as well as to facilitate the movement of freight trains, that it was determined to cut down the grade at the same time the other improvements are made.

The 275 foot tunnel at present under Main Street is to be removed, and the existing grade crossing at Harrison Avenue will be eliminated. The 16 foot arch bridge at Arch Street will be replaced by a 40 foot arch under which the street will run. This new bridge will be 150 feet long, and will contain 6,000 cubic yards of masonry. Owing to the fact that the tracks at this point are 50 feet above the ground, this arch will be a very expensive one to construct.

Reinforced concrete bridges will be built at Maple Street, Main Street, and Pennsylvania Avenue, and the cut between Main Street and Pennsylvania Avenue will be widened to accommodate four tracks.

At Harrison Avenue the Company proposes to build a tunnel 100 feet long under the tracks for the use of passengers and pedestrians, and in addition an arch will be built joining Harrison and Brushton Avenues. The proposed bridge will be 235 feet long, as the tracks are on a very high enbankment at this point. This bridge will contain 10,000 cubic yards of masonry. The new station will be commodious, and will have island platforms for the use of passengers.

In addition to the above improvements, the railroad company will lay out, grade and pave three new streets. This will involve the laying of 10,000 square yards of street paving, 6,000 yards of sidewalk paving, and 3,000 lineal feet of curbing. The total amount of enbankment to be placed for the entire work will be about 180,000 cubic yards, and the excavations will approximate 100,000 cubic yards.

In connection with the work at Greensburg, the railroad is to construct an undergrade connection between the Main Line and the Southwest Branch. This will eliminate the crossing at grade of the eastbound tracks by Southwest Branch trains.

The contract for the Greensburg work will be the third important one let this year for New York by the Pennsylvania Railroad. In addition to these, the Pennsylvania Lines are planning to spend $7,000,000 in removing the grades and adding to the double track roads west of Pittsburg and Erie.

Efficiency Tests

Over 156,000 efficiency tests were made by the Pennsylvania Railroad in the first six months of this year, and practically a perfect record was made by the employes. These figures are shown in a report issued today by the railroad. The average number of tests made each day was 862, and of the total for the six months, 99.6 per cent were perfect. In the .4 per cent of failures are included the cases where enginemen passed signals by a few feet before stopping their trains, and similar cases, which, though technical violations, were not such as would make possible an accident to a train.

Efficiency, or surprise tests, are conducted by officials of the Pennsylvania Railroad, who, at unusual times and places, set signals at caution or danger, extinguish signal lights, display fusees, or place torpedoes on the track, with a view to keeping enginemen constantly on the alert for any and all signals. In conducting surprise tests the officials sometimes extinguish signal lamps, and while enginemen may stop at the signal, failure to report the dark lamp at the next station lays them liable to suspension. Failure to observe any of the rules regarding the operation of trains is disciplined.

The tests made in the first six months of this year were divided into four classes, in which the following records were made by the men: Block signal rules, 24,292 tests, of which 99.6 per cent showed perfect observance on the part of employes; rules governing flagmen, and the use of fusees, torpedoes, and other signals, 23,042 tests, with 99.5 per cent perfect; trains ahead of schedule time, 53,503 tests, with 99.7 per cent perfect; signalmen relieving each other, 99.9 per cent perfect out of 56,112 tsts.

The New York Division—the line between New York and Philadelphia—showed a perfect record in all signal tests, as did the Cresson and the Central Divisions. On the Sunbury and Shamokin Divisions a total of 8,732 signal rule tests were made and in only 9 cases was the observance imperfect. Nine of the 26 divisions reported perfect observance of all block signal rules; five were perfect in other signals, twenty-one in trains running ahead of schedule time, and ten in signalmen relieving each other.

Transportation of Dangerous Articles*

By Col. B. W. Dunn.

My object this evening is to secure the approval and the support of the members of this club for work of the Bureau of Explosives, to the end that destruction of life and property incident to the transportation of dangerous articles may be reduced to a minimum. I feel that however imperfect my presentation of it may be, my subject demands your attention.

Reports that reach my office show too frequently an indifference to this work on the part of good and efficient railway officials; a tendency to trust the education of railway employes and shippers in the requirements of the regulations to the unaided efforts of local inspectors and to leave the examination of the reports of these inspecors and the remedial action on them entirely to your clerical assistants.

We cannot expect employes in the lower grades to take a zealous interest in matters to which their superiors are indifferent. The safe transportation of a carload of dynamite, the control of its appalling potentiality for destruction as it passes through our thickly populated centers, does not depend upon any one man. When disasters have occured in the past blame has been placed on one man whose ignorance or carelessness was in immediate evidence. Perfect knowledge and justice would lead us to enlarge this mantle of responsibility to cover other men, distant from the scene whose errors of commission, or omission, are prime contributary causes. Officials who have not handled, or even seen the explosives, may be called upon justly to assume the major part of the blame.

Let us assume a hypothetical case for illustration. A large shipper of inflammable articles is located at a point where strong railway competition exists, and he resents the requirements of the regulations that he must learn the characteristics of his materials, pack these materials properly for shipment, designate by prescribed labels those packages liable, when handled roughly, to cause fires, and certify on his shipping order that he has performed these duties. The first impulse of such a shipper is to threaten a diversion of his custom to a line that will not enforce these restrictions, so essential for safety and so objectionable to him. Assume that he finds a line whose freight solicitor, encouraged possibly by his traffic department, is willing to recommend that the published rules of his operating department be disregarded to secure the valuable patronage of his shipper, or to avoid losing it, and the operating official, with the excuse that his principal duty ends with the promulgation of proper rules, does not see fit to interfere. As a result, inflammable freight is received and treated as ordinary merchandise and is loaded in a car with dynamite. In a switching movement in one of our large cities, this car is coupled at a speed in excess of the prescribed limit, and a fire is started in the inflammable freight that explodes the dynamite and causes loss of life. Public sentiment is aroused and demands a victim. The engineer and the signalman, if not killed by the explosion, are pilloried for their rough handling of the car. Should not a greater blame rest upon the unreasonable shipper, the overzealous freight solicitor, the prompting traffic official and the indifferent operating official. Remember, that the above is a hypothetical case and it is to be hoped that it will never be realized.

*Extract from paper read before Central Railway Club.

It will be evident to any careful observer, that a responsible railway official can no longer secure absolution from blame for a disaster that affects the public safety, by pointing to a proper set of rules duly promulgated. He must be able to show that he has also taken all practicable steps to see that his subordinates understand and obey his rules.

It is reasonable to assume that a succession of contributing causes led up to each one of the deplorable accidents that have occured in the transportation of dangerous articles. The higher your position as an operating, or as a traffic official of your line, the greater will be your opportunities to accelerate or retard the work of the Bureau of Explosives. I do not apologize, therefore, for asking you to listen to a sketch of the origin, scope and objects of this work.

Ever since our forefathers undertook the conquest of this continent we have been a reckless and a wasteful people. We have wasted our lives as readily as we have squandered our material resources, our forests and our coal. The typical American resents nothing so much as an insinuation against his courage. If the safety of a railroad bridge is in question you will find an engineer ready to investigate it with his engine. With no other basis than a limited experience in handling fire arms, you will find a man ready to use his own judgment in handling dynamite. While these are the qualities desired in soldiers whose officers are present to control them, safe transportation requires a tempering of rashness by knowledge. A brave and a wise man handles explosives when necessary but always with care and his respect for their power to destroy, his fear if you please, grows in proportion to the increase in his knowledge. As explosives became increasingly essential to our business interests, they were received by our railroads and placed in the same stream of traffic that carried farm products, groceries, dry goods and coal. A car good enough for one was good enough for all. When cracks and holes in car bodies were closed, it was more to prevent damage to valuable goods by rain, than to prevent ignition of explosives by sparks. As the volume of traffic increased, necessity developed the "hump' in classification yards and the automatic coupler and both increased enormously the average shock to a package of freight during transit. To save cost of car repairs, the strength of cars was increased while little or no attention was paid to the strength of packages containing explosives.

The natural result of all this was a series of disastrous explosions that were more in evidence on one road for the simple reason that the traffic of the line in explosives was much in excess of that of any other line. Its officials had been duly impressed with the seriousness of the danger attending this traffic and had secured from the American Railway Association approval of a resolution authorizing the appointment of a committee to draft regulations for uniform adoption and enforcement by all lines, when an explosion of a car load of dynamite at Harrisburg in May, 1905, caused the deaths of 23 persons, injured many more and cost the Pennsylvania Railroad in round numbers about $500,000. This line had promulgated regulations designed to safeguard this traffic, but it had not been made the special duty of anyone to see that these regulations were understood and enforced. Immediately after the accident, the position of Inspector of Explosives was created by the Pennsylvania Railroad and a competent man was kept circulating among shippers of explosives and railway employes, explaining the rules and checking their violations of them. The official who suggested the creation of this position is the father of the Bureau of Explosives. The seed of the idea is contained in the axiom "Regulations do not enforce themselves." In spite of the long period of neglect of precautions in handling explosives, there was an underlying consciousness of the necessity for such precautions. Without this consciousness to act as a fruitful soil to stimulate the growth of this seed, the influence and the work of the Bureau of Explosives could not have had the phenominal growth that has characterized its short existence.

BUREAU WORK.

The bureau proposes regulations for the approval of operating officials and it compiles from all sources the results of experience in the practical operation of these regulations for use in improving them.

The country is divided into districts and to each district is assigned a local inspector whose duty it is to educate shippers and railway employes in the requirements of the regulations and to report their violations of them to a designated operating official and to the Chief Inspector.

A properly equipped chemical laboratory is maintained for the technical examination of samples of dangerous articles of all kinds.

The Chief Inspector is called upon frequently by operating officials for expert opinion and advice on a great variety of subjects. His correspondence with the local inspectors is voluminous and the constant touch that he keeps with this work, through their daily reports and his comments enables him to harmonize their actions and to make each inspector benefit by the experience of all.

REGULATIONS.

Railway officials, as a rule, have not found time to study the regulations proposed by the Bureau and promulgated by them. Those who give them a superficial study usually reach the conclusion that they are too voluminous and too technical. One official informed me that after reaching this conclusion he forced himself to further study and was surprised to find the number of points not covered. He appreciated then one of the difficulties of the Chief Inspector whose task it is to cover all important contingencies and yet keep the regulations as short and simple as possible. It will be useful for you to have the skeleton

of these rules in mind and to appreciate the principles on which they are based.

There are distinctive duties that can be performed only by the shipper and the carrier, respectively. The shipper must see that his material is properly manufactured, packed, marked and described. If it has characteristics that necessitate special treatment, information of these characteristics must be given the carrier in a practical way. For the comparatively small number of explosives, this information can be conveyed by the names that appear on packages and on shipping orders. For the very large number of inflammable materials and acids, bearing frequently chemical and trade names, a distinctive label is the most practicable means of showing at once to the carrier the class of the articles, its transportation risks and the precautions necessary to avoid fires. If all shippers were as honest and law-abiding as the majority of them are, we could stop here. It is necessary, however, to go further and request that after performing the above duties they certify on their shipping orders that they have done so. The honest and well informed shipper does not object to this certificate. Honest and ignorant shippers are forced by the certificates to inform themselves on the regulations with which they must certify a compilance. Even the shipper who has no real regard for the truth, and welcomes an opportunity to make the railroad pay for a loss due to his negligence, will hesitate before subscribing to a falsehood. It looks too much like paving the way to a just retribution.

In the presence of keen competition for traffic and in the absence of a representative central organization, such as the Bureau of Explosives, it has been impossible, heretofore, for any line to insist that its shippers perform their duties. It will require technical knowledge, mental force, energy, diplomacy and time, for the Bureau to effect so radical a change in the practice of the average shipper; but the great advantage to our members is that this effort can be made by the Bureau without concentrating the local antagonism of shippers upon any one line.

Assuming that the shipper has delivered his package in proper condition and with all necessary information, let us examine the essentials of the carrier's duty.

The receiving clerk must inspect the package. He has not the time to open it and would not get much information if he did. He can, however, detect ruptured or leaking conditions, or evident weakness liable to lead to leakage. He must also verify the proper prparations and certification of the shipping order and the labeling of the package when labeling is required.

The billing clerk must make the prescribed endorsements on way bills since this is the only practicable way to let other railway employes who handle the package en route know that it has been started right and that the shipper, as well as the initial carrier, have performed their duties.

When loading is delayed, as safe a storage as is practicable must be provided on the freight platform. For example, a dangerous package should not be left in the path of moving trucks, and packages bearing inflammable labels should not be piled with explosives. Dangerous packages, necessarily kept over night, should be stored in a well understood location where their removal in case of fire will be facilitated.

The best car available should be provided for dangerous explosives and in no case should it fail to have the essential qualities specified by the regulations for this freight. The prescribed placards that do duty as silent sentinels should be placed on guard to advertise the necessity for careful handling and the keeping of lights and fire away.

All dangerous packages must be loaded in the best practicable way to prevent their falling and to prevent other freight falling on them during transit. When necessary, they and other freight must be braced and blocked. The accident reports coming to my desk show conclusively that a good foreman can save for his company much more than his wages every time he uses good judgment in storing packages in a car. Your auditor startles you with the grand totals of your paid claims for damaged freight, totals that have been known to amount to a fair dividend on capitalization, and accident reports show that expensive fires are caused not infrequently by a casting, or a piece of machinery, or other package, falling on a box of matches, or a box of fireworks, or a box of drugs. You promote the smoothness of your passenger tracks by periodical testing with proper apparatus and by offering prizes for competing track gangs. Let me suggest that you do more to develop a skillful loading of your cars, increase the importance of the loading foreman and see that just when part of the lading is removed the remainder is trimmed and adjusted more carefully to continue the journey.

After loading a car with dangerous freight it must be given the protection of the safest location in the train, kept away from fire and relieved of all unnecessary shocks. I wish to emphasize the suggestion that the placards on these cars are silent sentinels unarmed except with their warning words. They represent the final outcome of all the tedious and expensive precautions taken by shippers and carriers to protect hazardous freight and these precautions are nullified when their warnings are disregarded by the criminally negligent employe who blunders into the car protected by them with fire or flame and without previous investigation to detect the possible presence of inflammable vapors. In such cases it is unfortunate that the sentinel-placards cannot be supplied with bayonets and the ability to use them. Many railway employes seem to be imbued with the idea that their duties end with the clerical work prescribed, that we are depending upon some magic power of the label and the placard to prevent or extinguish fires. The vapors from a leaking shipment of gasolene were ignited recently by the

taking of a lighted lantern into a placarded car immediately after opening the door. Another employe when reprimanded for placing hot ashes on the floor of a car suggested in all seriousness the placing of a placard on the car to avoid danger.

When the dangerous freight arrives at destination, the last duty of the carrier is to enforce prompt delivery. A fire started recently in a railway station building that was also a storage warehouse and contained about 2,000 pounds of dynamite, some of which had been on hand for more than 10 days. When informed of the presence of the dynamite, the fire brigade found urgent business elsewhere and the explosion scattered burning brands that caused the destruction by fire of practically the entire village.

If you admit the reasonableness of the above skeleton of the essential duties of shippers and carriers of dangerous freight, you admit the necessity for the regulations. If the details of these regulations are not satisfactory your suggestions for their improvement will be more than welcome. If you will acquaint yourself with the actual conditions on your line, you will appreciate the difficulty in educating your numerous shippers and employes in these details. They must be taught and then they must be made to obey. Your regular organization cannot accomplish these ends. Add to your difficulties those of all other roads and you will be ready to transfer the burden to the Bureau of Explosives. When you reach this conclusion, remember that each and everyone of you can still help or hinder the progress of the work by your personal attitude and influence. When you meet a man, who from a snap judgment or from false premises, has reached a different and an erroneous conclusion, enlighten and enlist him.

Empire Suspension Bridge

The suspension bridge over Culebra Cut at Empire was opened to the public at 5 o'clock on Saturday afternoon, July 31. The flags of Panama and the United States had been hung over the bridge at the point where the opening ceremony was held, and some red, white and blue bunting had been draped on the towers at either end. In the presence of a number of residents of Empire and Culebra (the Division Engineer of the Central Division, and the men who built the bridge, Mrs. A. S. Zinn, wife of the Resident Engineer, broke a bottle of champagne and declared the bridge open to traffic.

This is the first bridge to be constructed across Culebra Cut. Its primary purpose is to carry the compressed air and water mains over the Cut, and thus avoid moving them every time a steam shovel crosses their line. As a highway bridge it will give access to Las Cascadas plantation and the native farms on the east side of the Canal. It is a temporary structure and will be taken down as soon as the Canal is opened to navigation, as it is only 108.5 ft. above the water line and would not clear the masts of larger vessels. The span is 600 ft., the length of cable from west to east anchorage 932 ft., and the roadway is broad enough for one wagon. The towers are made of creosoted timber and are 60 ft. high. There are four 2¾-inch steel cables anchored at the eat end to old French rail embedded in 189 cu. yds. of concrete, and at the west end to French rail in 270 cu. yds. of concrete. Work was begun on March 11, 1909, and the manual labor was performed entirely by negroes.—The Canal Record.

Fire-Killed Timber

How long will timber remain commercially valuable after it has been swept over by a forest fire? Timber land owners as well as the Federal Government are much interested in obtaining this information, and the Government has just begun an investigation of a large number of fire areas in Oregon and Washington in order to determine, if possible, the length of time which will elapse after a great forest fire before the timber deteriorates to such a condition as to decrease its commercial value.

The agencies which cause timber to decay and encourage the attack of wood borers are undoubtedly influenced to a greater or less degree by the intensity of the original fire and the climatic conditions and altitude of the burned areas.

All the information in connection with this investigation will be obtained first hand by the Forest Service, either from government timber land, or from private holdings where logging operations are under way.

In this connection the Forest Service has also undertaken an investigation to determine the relative strength of green and fire-killed timber. The material which is to be tested is being sawed at the mill of the Eastern and Western Lumber Company, of Portland, Ore., where it will be surfaced to exact sizes and then transported to Seattle, where tests will be made in connection with the Forest Service exhibit at the A. Y. P. Exposition.

The fire-killed trees which are to yield material for these tests were selected by representatives of the Forest Service on the holdings of the Clarke County Timber Company, of Portland, Ore., near Yacolt, Wash. This timber was burned over seven years ago and represents fairly well the average of burned timber found in the Pacific Northwest. The logs, which vary from three to four feet in diameter, were sawed into 32-foot lengths. These are being manufactured into 16-foot floor joists and bridge stringers.

The results of these tests are being anticipated with great interest by Forest Service engineers and by the lumbermen of the Northwest, because they are expected to disapprove the opinion generally held regarding the strength of fire-killed timber.

Cross Ties

In furtherance of its policy to prolong as long as possible the life of cross-ties and thereby minimize the consumption of timber, by treating ties with creosote, as well as by growing trees for cross-tie purposes, the Pennsylvania Railroad Company has just awarded a contract for the erection of a complete pressure wood-preserving plant at Point House Pier, Greenwich Point, Philadelphia. In addition to the plant to be constructed, the company has one at Mt. Union, Pa., and a small experimental plant at Greenwich Point, both of which are in successful operation.

It is estimated that proper treatment will increase the life of cross-ties from two to three-fold. Applied to all of the 100,000,000 ties which American railroads use annually, it would greatly reduce the drain on the rapidly decreasing timber resources. The Pennsylvania Railroad alone uses from 3,500,000 to 4,000,000 ties each year for renewals and new work. The average life of these red oak and chestnut ties under present conditions in main running tracks is from three to four years, while white oak lasts from seven to eight years. It is estimated that preservative treatment will increase the life of red oak and other treatable ties to at least fifteen years. The Pennsylvania Railroad's enormous requirements for ties and lumber strip the timber from some 50,000 acres annually. It is estimated that by proper treating with preservatives even a part of this timber, its life will be so increased that perhaps 25,000 acres will supply the company's requirements.

A contract was placed in November of last year for the construction of a tie treating plant at Mt. Union, and for two large creosote storage tanks to be located at Greenwich Point. The new plant to be built at Philadelphia will be similar to the one now in operation at Mt. Union, except that it will be designed to accommodate an additional cylinder whenever it is needed. The building will be 50 feet, and of steel frame and corrugated iron construction. It will be absolutely fire proof. In connection with the tie treating plant, there will be a storage yard covering an area of about 25 acres along the Delaware River. This will afford a storage capacity for from 750,000 to 1,000,000 ties. Storage tracks will be built, and a 24-inch gauge track will be laid for the operation of the cylinder cars.

In addition to ties, many other classes of material will be given preservative treatment, including bridge timbers, telegraph poles, cross-arms, planking and shingles.

The capacity of the one cylinder will be from 750,000 to 1,000,000 ties per year, working day and night shifts. The two treating plants of the Company will have a capacity of 1,500,000 ties per year.

Pennsylvania Tunnels

The Pennsylvania Railroad has completed the construction of its tunnels under Bergen Hill and the Hudson River into its station at Seventh avenue and Thirty-third street, New York City. The final inspection has just been made by Mr. Samuel Rea, second vice-president of the Pennsylvania Railroad Co., and Mr. Charles M. Jacobs, chief engineer of the North River division, and the work has been pronounced in condition to proceed with electrification, signaling and track laying. This will be undertaken immediately and pushed forward as vigorously as possible.

The Hackensack portal is located 6.1 miles from the junction with the main line at Harrison, just east of Newark, N. J. A temporary track has been installed on the embankment from Harrison to the portal, and materials for the track laying will be carried over this line and into the tunnels, thus avoiding the inconvenience to the public of having this material carted across Manhattan Island.

Thus culminates the construction work on the first two tunnels to be built for trunk line service under the Hudson River. The first excavation was begun May 12, 1905. The north tunnel was joined on September 12, 1906, and the south tunnel on October 9, 1906. The tunnels under Bergen Hill were connected on May 7, 1908, and April 11, 1908, respectively.

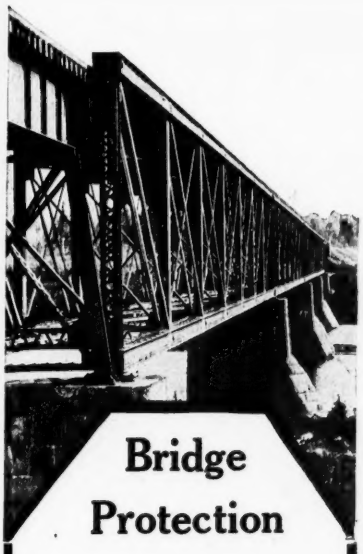
These two tunnels, which are 23 feet in exterior diameter, are lined with 2 feet of concrete and therefore are of 19 feet interior diameter. They extend from Hackensack portal under Bergen Hill to Weehawken shaft, a distance of 1.2 miles, and from the latter shaft to Ninth avenue, New York, 1.4 miles.

In the course of their construction 501,995 cubic yards of material have been excavated. For blasting, 1,201,000 pounds of powder have been used. All of the subaqueous tunneling was done under compressed air, and for this purpose 3,770,000,000 cubic feet of air were pumped into the tunnels. For use in drilling operations, 212,420,000 cubic feet of compressed air were utilized.

The tunnels contain 64,265 tons of cast iron and steel, while in addition 740 tons of structural steel were used. In bolting the segments together 2,606 tons of steel bolts were utilized. In the various concrete linings 240,500 barrels of cement were consumed and 170,400 cubic yards of concrete were installed. In addition, there were 4,980 cubic yards of brick work, and in the benches alongside of the tracks 1,827,396 duct feet, or 346.1 miles of conduits were installed.

Southern & Southwestern Railway Club

The last meeting of the Southern & Southwestern Railway Club was held at the Mechanical & Manufacturers' Club, 17th floor, Candler building, August 19, 1909. At this time Dr. T. A. Hancock, who has for eighteen years been surgeon of the Southern Railway, gave a lecture on "First Aid to the Injured." He handled the subject in a very thorough manner, both in reference to shop usage and also on line of road.



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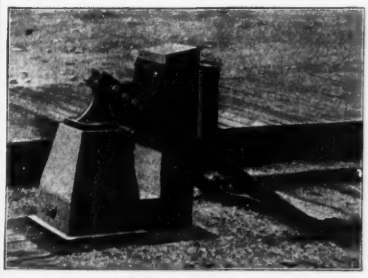

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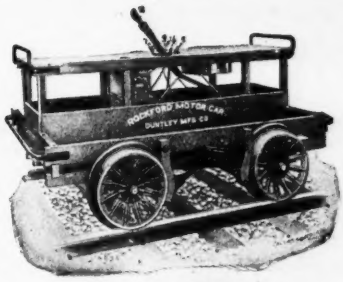

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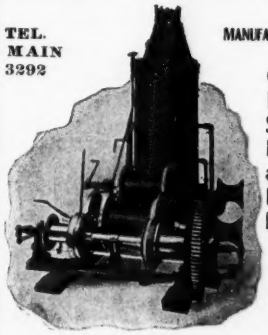

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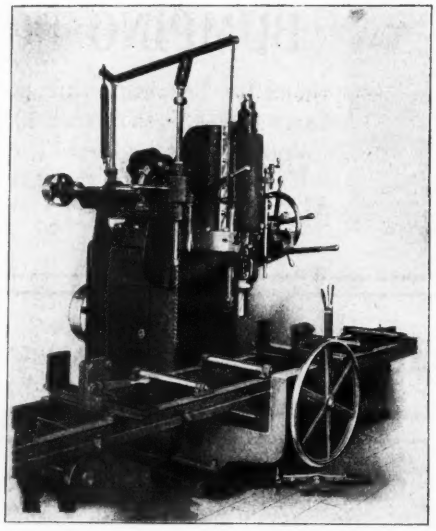
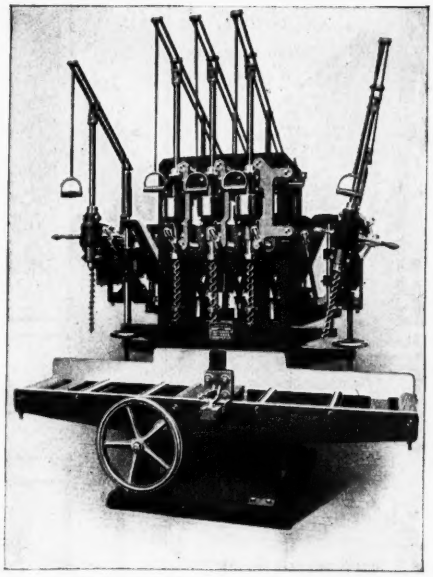
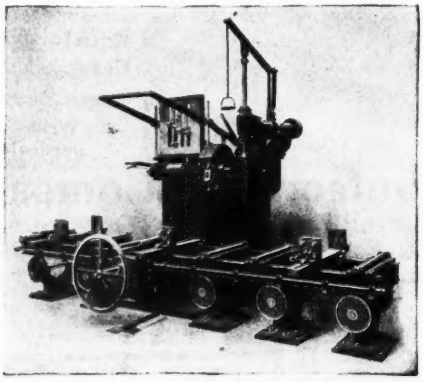


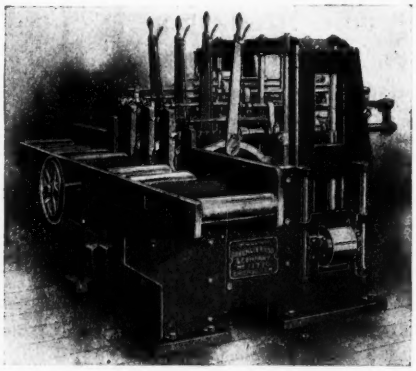
No. 225—Vertical Automatic Hollow Chisel Mortiser.



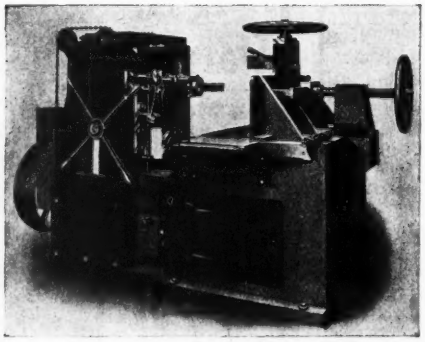
No. 327—Vertical Car Boring Machine with Universal Spindles



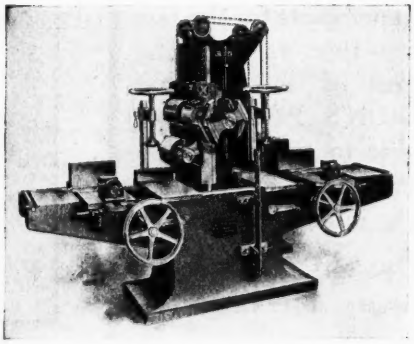
No. 512—Extra Range Automatic Car Gainer with Boring Attachment.



No. 306—Extra Range Horizontal Car Boring Machine.



No. 218—Extra Range Automatic Hollow Chisel Car Mortiser.



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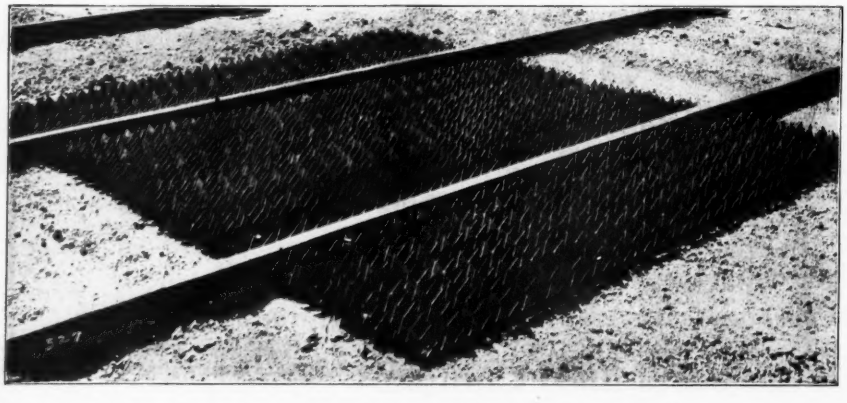

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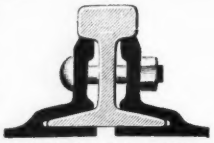

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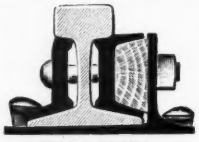

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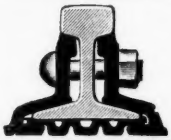

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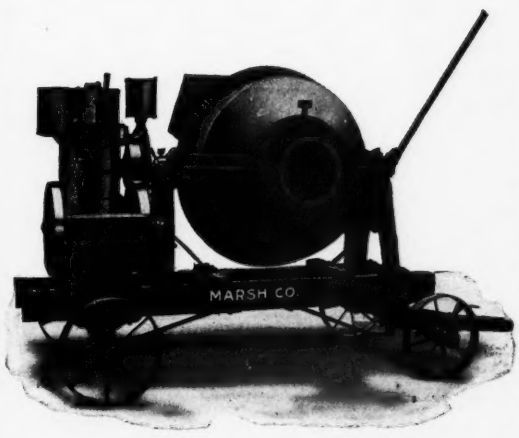

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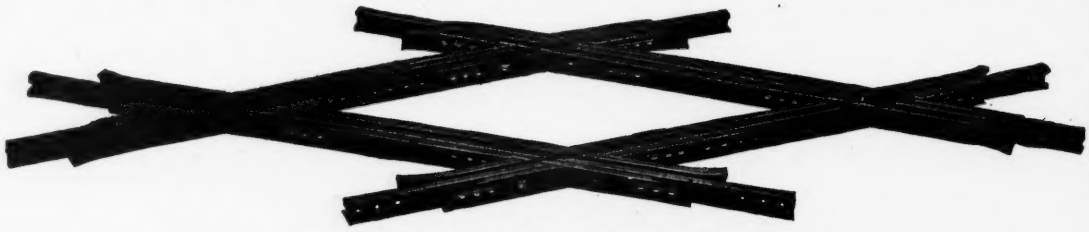

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